DEVOTED TO
TEXTILE CHEMISTRY
AND
WET-PROCESSING
BLEACHING
DYEING
PRINTING
FINISHING

APRIL 4, 1949
VOLUME 38, No. 7

AMERICAN DYESTUFF REPORTER

APR 7

Light fastness improved

You must admit those colors are rare whose light fastness is only minorly affected by the popular anti-crease finishes.

When light fastness is actually *improved* by such finishes then the peak in efficiency has been reached. That efficiency is found in

Cuprophenyl Red B L°
Cuprophenyl Navy Blue R L†
Cuprophenyl Navy Blue B L†
Cuprophenyl Grey 2 B L°
Cuprophenyl Brown 2 G L°

They are in the new range of Cuprophenyl* colors—a series of Direct colors for cotton and rayon which, with an inexpensive aftertreatment of copper sulphate and acetic acid, gives outstanding resistance to washing, perspiration, salt water and light.

Keep abreast of the latest developments in the Cuprophenyl series.

°*P. A. F.*
†*Patented.*
**Registered U. S. Patent Office.*

GEIGY COMPANY, INC.

89-91 BARCLAY STREET — NEW YORK — NEW YORK

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Charlotte, N. C. · Portland, Ore.
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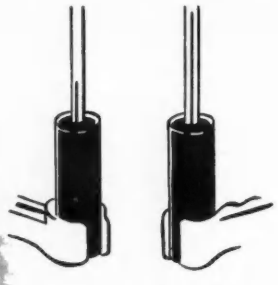
Geigy
Dyestuff Makers Since 1859

In Great Britain
The Geigy Co., Ltd.
National Buildings
Parsonage, Manchester

OFFICIAL PUBLICATION
of the
PROCEEDINGS
AMERICAN ASSOCIATION
OF TEXTILE CHEMISTS
AND COLORISTS



SPEEDIER APPLICATION in the wetting of textiles is achieved with DECERESOL Wetting Agents. Low surface tension of liquid containing DECERESOL OT is illustrated here by the capillary method. Tube on left contains a 0.01% solution of DECERESOL OT 100%, tube on right plain water.

Win both eye and hand approval with NO-ODOROL* finishing oils

Today the hand is often quicker than the eye in deciding a sale. For women are becoming increasingly finish conscious.

Cyanamid offers a full line of specialties that helps textile manufacturers achieve superior processing results. NO-ODOROL Finishing Oils, as an example, are extremely effective as softening agents for cotton, silk and rayon fabrics, and for hosiery and knitted fabrics. Grades are available for use on the finest fabrics as well as for heavy work clothing fabrics—priced to meet every requirement, with quality always maintained.

NO-ODOROL Finishing Oils are only one of a varied line of Cyanamid sulfonated oils and other textile specialties which include penetrants, softeners, finishes, sizing compounds, DECERESOL* Wetting Agents, PARAMUL* 115 Water Repellent and others. Our technical staff and research facilities are at your service in applying these products to your business.

Write for a copy of our booklet, "Textile Specialties".

**Reg. U. S. Pat. Off*

WATER BORNE STAIN RESISTANCE PLUS water repellency can be imparted in one treatment with Cyanamid's PARAMUL 115, a semi-durable water repellent. Easy and economical to use, it is equally suitable for cotton, rayon, linen and wool.

AMERICAN Cyanamid COMPANY

INDUSTRIAL CHEMICALS DIVISION, DEPT. E4

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

American Dyestuff Reporter, Vol. 38, No. 7, April 4, 1949. Published every other Monday. Copyright 1949, by Howes Publishing Co., Inc., One Madison Ave., New York 10, N. Y. Domestic subscription, $5.00; Canadian, $6.00. Foreign, $10.00. Entered as second-class matter, Nov. 6, 1919, at the New York, N. Y., Post Office, under the act of March 3, 1879.

for.....

LIGHT FASTNESS ON RESIN TREATED FABRIC

CHLORANTINE FAST:

YELLOW	RLSW
ORANGE	3GL
BROWN	6GLLU
SCARLET	BNLL
RED	6BLL
VIOLET	2RLL
BLUE	7RLL
BLUE	BLL
BLUE	5GLL
BLUE	BCL
GREY	GRL

These . . .

maintain maximum light fastness after urea formaldehyde resin treatment . . . for stabilization and crush resistance.

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CORPOLIN®

HYGROSCOPIC AND PLASTICIZING AGENT

PROPERTIES . . .

CORPOLIN is a heavy non-volatile liquid—clear, colorless, odorless, free-flowing.

Resembles glycerin in feel and appearance.

A highly concentrated solution of organic compounds in water, containing 70% solids.

NON-TOXIC; NON-FLAMMABLE; no freezing point.

USES . . .

Attracts and retains the right amount of moisture in VAT PRINT PASTE. Replaces glycerin at ½ the cost, without change in formulation.

Introduces valuable economies through its power as a humectant.

Makes textile fabrics and paper flame-resistant.

Excellent for sizing, finishing and weighting.

Technical data sheet and samples forwarded on request.

THE AKTIVIN DIVISION

HEYDEN CHEMICAL CORPORATION

393 SEVENTH AVENUE, NEW YORK 1, N. Y.

How processing can make or break the "beauty value"

When fabrics possess that certain "look" of beauty, an important part of this added value comes from proper processing.

That explains why so many of America's leading mills, converters, finishers and dyers have turned to Colgate-Palmolive-Peet for high-quality wetting, fulling, scouring and dispersing agents.

Remember, there is a C.P.P. soap or synthetic detergent for every type of fabric—for every processing problem. Ask your local Colgate-Palmolive-Peet representative for details. Or, write today to Industrial Department, Colgate-Palmolive-Peet Co.

Photographed here, a 100% cotton plaid. Washable. Comes in shades of blue with maize; shades of red with gray; shades of blue with red; shades of red with brown and maize.

COLGATE FORMULA 25

For low-temperature washing ordinarily requiring olive oil soaps. Sold in eastern states only.

COLGATE WHITE SOAP FLAKES

High-grade thin white flakes. Not milled or polished. 90% anhydrous soap.

ARCTIC CRYSTAL FLAKES

Made from pure tallow, guaranteed to contain 88% or more soap. Titer approx. 42°C.

ARCTIC SYNTEX A, T, AND M

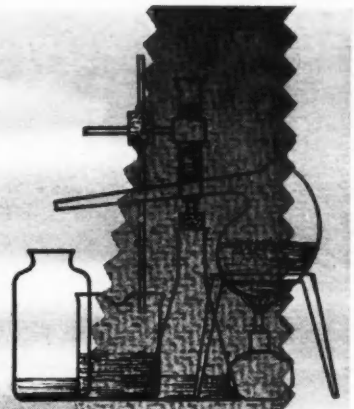
Synthetic detergents and wetting agents. Unsurpassed for many processing operations.

COLGATE FORMULA 10

92% oleic acid soda soap in flake form for silk degumming, wool scouring, all textile processing.

Colgate-Palmolive-Peet Company

Jersey City 2, N. J. • Atlanta 3, Ga. • Chicago 11, Ill. • Kansas City 3, Kans. • Berkeley 2, Calif.



REPCOLENE K-50

..... applicable to all fabrics

REPCOLENE K-50 has a wide field of application as a penetrating—scouring—wetting—leveling, dispersing agent

STABLE IN HARD WATER—COMPATIBLE WITH SOAP

REPCOLENE K-50 has great softening action on animal and vegetable fibres.

REPCOLENE K-50 is economical as it greatly reduces the amount of finishing compound required after scouring and dyeing operations

WRITE FOR COMPLETE INFORMATION SHEET

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Announcing

A New Product for DYERS and PRINTERS

LOMAR PW the new dispersing agent developed by Jacques Wolf & Co., assures more efficient and economical processing.

• *In Dyeing*

Level shades and uniform absorption of dyestuffs by the fibres, depend largely upon an even dispersion of colors in the dyebath. The addition of a small amount of LOMAR PW in pasting up indanthrenes or acetates solves this problem.

• *In Printing*

When added to the printing paste, LOMAR gives finer particle suspension, improved flow and smoother consistency. By keeping the colors in suspension, LOMAR PW assures efficient, economical results.

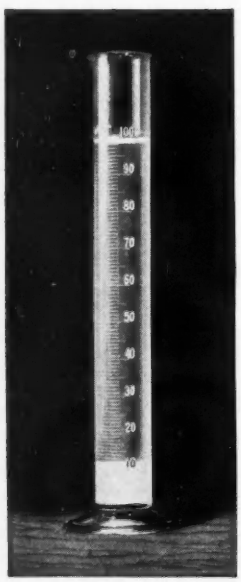
• *In Backfilling*

In backfilling, LOMAR PW is added to the heavy backfill mixture of clay and starches to give uniform suspension of the clay, good flowing properties and more uniform results on the fabric.

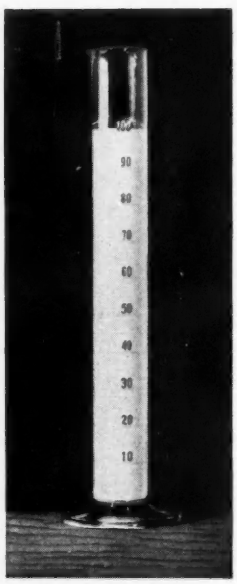
For complete information on LOMAR PW, send today for your copy of Bulletin No. 21.

TYPICAL OF THE DISPERSING ACTION OF LOMAR PW

The contents of these two graduates are identical, except for a small percentage of LOMAR PW. Note the continued even suspension and dispersion in the right hand graduate after standing ten times as long as the one at the left.



Blanc Fixe after 30 minutes — no dispersing agent



Blanc Fixe after 5 hours — plus LOMAR PW

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JACQUES WOLF & CO. *Chemicals* PASSAIC, N. J.

Latest Additions

AMANTHRENE* VAT COLORS
provide the answer to the demand for
better color fastness in textiles

Amanthrene

SCARLET G paste
ORANGE R paste
PINK FF paste †

Vat printing colors of distinction.
Their delicate, brilliant shades satisfy
the most exacting specifications.

Without a peer for the printing of fine cotton
and rayon dress goods and draperies, as self colors or
in combinations. Equally suitable for dyeing
the same fibres. Offering the particular advantages
of fine, smooth pastes.

Just three of the Amanthrene range of superior vat colors.
For detailed information on the whole range available, as well as
data regarding your own particular requirements,
consult our nearest branch. A.A.P. technicians are always
happy to be of service.

†Also available in double powder form

AMERICAN ANILINE PRODUCTS, INC.

50 Union Square, New York, N. Y. • **Plant: Lock Haven, Pa.** • **Branches:** Boston, Mass.
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*Reg. U. S. Pat. Off.

AHCOVELS

put nature's softness in your fabrics

- AHCOVELS are permanently resistant to usual laundering and dry cleansing processes.
- AHCOVELS are stable under extreme heat.
- AHCOVELS are odorless and will not discolor.
- AHCOVELS E. F. and R, assure full retention of light fastness of any color.

There is a *specific* Ahcovel to give cotton, wool and synthetic fabrics finer finishes, softer drape and hand . . . and with economy too. We will be glad to supply you with additional information or recommendations with regard to specific finishing problems on request.

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Votator

STARCH COOKING APPARATUS

This Votator unit cooks and plasticizes 4000 pounds of smooth, homogenous backfill per hour.

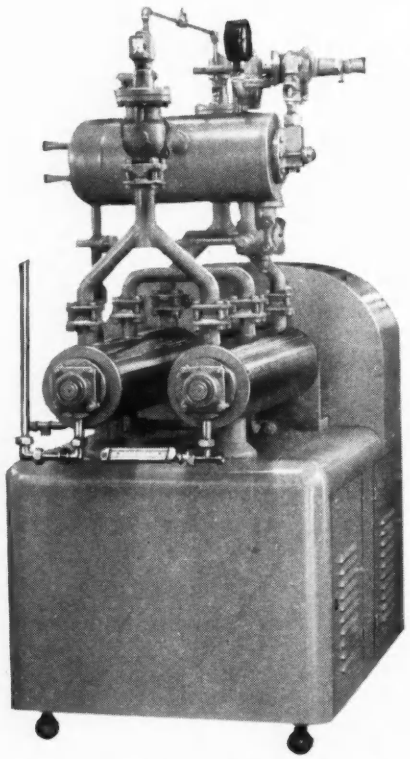
for the continuous, closed, controlled processing of

- **STARCH PASTE**
- **VAT REDUCTION PASTE**
- **VAT STANDARD PASTE**
- **BACKFILL**

A continuous flow of material, in a closed, controlled system. That's the idea behind Votator starch cooking apparatus. It's basic. It's versatile. And the advantages of Votator starch cooking apparatus are being applied to more and more textile starch processing problems.

Generally speaking, Votator starch cooking apparatus functions in less floor space than is otherwise required and with less manpower. There is no spillage, no waste. Control over quality is mechanical, foolproof. Use of heat transfer medium is effective, economical. Continuous processing under pressure permits higher cooking temperatures than are obtainable with open kettle methods.

Write for case history facts about the application in which you are interested.



When we say Votator starch "cooking" apparatus, we mean cooling, too. One Votator unit raises the temperature of vat paste to 230° F. in seconds. Then this Votator unit swiftly cools the paste as it flows through the closed controlled mechanism.

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VOTATOR DIVISION
LOUISVILLE 1, KENTUCKY

150 Broadway, New York 7, N. Y.
2612 Russ Bldg., San Francisco 4, Cal.
Twenty-two Marietta Bldg., Room 1600, Atlanta 3, Ga.

VOTATOR *is a trade mark (Reg. U. S. Pat. Off.) applying only to products of The Girdler Corporation.*

one quality... the highest

HERCULES

PINE OILS

time-tested reagents for wet processing

Send for testing sample to
HERCULES POWDER COMPANY
INCORPORATED
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HYS-1

NYANZA

ANILINE & ALIZARINE COLORS

•

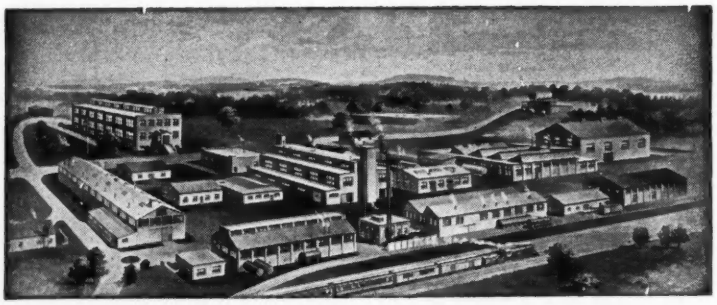
TEXTILE CHEMICALS

•

FINISHING MATERIALS

FOR

WOOL — COTTON — RAYON — ACETATE
AND MIXED FIBERS



FACTORY AT ASHLAND, MASSACHUSETTS

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109 WORTH STREET NEW YORK 13, N. Y.

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When you want a high quality product from your reactions with toluene derivatives, you will find no better assurance than by using Hooker Benzoyl Chloride, Hooker Benzyl Chloride or one of the other Hooker products.

Years of experience in chlorination techniques plus high purity chlorine from the Hooker "S" Cell and carefully selected raw materials, make these Hooker intermediates the highest quality obtainable. Ten Hooker toluene derivatives provide you with a choice that will best meet your requirements from the standpoint of end product desired, ease of handling, yield and cost.

Listed below are the principal properties and uses of Hooker Benzoyl Chloride and Hooker Benzyl Chloride—most widely used of the Hooker toluene derivatives. Technical Data Sheets and samples are available to qualified personnel when requested on your letterhead. Bulletin 320, also supplied on request, gives more detailed information on the reactions of these Hooker products.

HOOKER RESEARCH PRESENTS
BIS(TRIFLUOROMETHYL)BENZENE

Para Isomer

Molecular Weight	214.11
Freezing Point	—40° to —50°C
Boiling Point	115°C
Specific Gravity, 20°/15.5°C	1.395
Refractive Index, n20/D	1.379

Hooker Bis(trifluoromethyl)benzene (xylene hexafluoride) is a clear, water white liquid. The product, a mixture of the meta and para isomers, is currently available in pilot plant quantities. A study of the literature indicates that it is of interest as a chemical intermediate in the preparation of dyestuffs and in the preparation of non-flammable dielectric and hydraulic fluids.

Technical Data Sheet No. 368 gives physical and chemical characteristics. Literature and samples are available to qualified personnel when requested on your business letterhead.

BENZOYL CHLORIDE

Formula	C_6H_5COCl
Molecular Weight	140.5
Freezing Point	—0.9°C
Boiling Point	198°C
Refractive Index n20 D	1.5536
Flash Point	72°C
Fire Point	85°C
Specific Gravity, 15.5°/15.5°C	1.219

DESCRIPTION

Colorless liquid possessing a pungent characteristic odor; it fumes when exposed to moist air.

USES

Benzoyl Chloride is a highly active chemical which can be used to introduce the benzoyl group into organic compounds, especially through Friedel-Crafts reactions. Other uses are in the manufacture of benzophenone, benzyl benzoates, synthetic perfumes, dyes and pharmaceuticals.

BENZYL CHLORIDE

Synonym	Alphachlorotoluene
Formula	$C_6H_5CH_2Cl$
Molecular Weight	126.5
Freezing Point	—43°C
Distillation Range	5° or less including 179.4°C
Refractive Index, n25/D	1.5365
Specific Gravity, 15.5°/15.5°C	1.107

DESCRIPTION

Colorless to light yellow liquid having a pungent odor. The above data are for the high grade product. Also available as a technical grade with a wider distillation range.

USES

In manufacture of intermediates, dyestuffs, perfume bases, plasticizers, resins, wetting agents, rubber accelerators, gasoline gum inhibitors, pharmaceuticals.

OTHER HOOKER TOLUENE DERIVATIVES

BENZYL ALCOHOL, TECH. · BENZOIC ACID · BENZOIC ANHYDRIDE · BENZOTRICHLORIDE · BENZYL THIOCYANATE · METHYL BENZOATE MONOCHLOROTOLUENE · SODIUM BENZOATE

From the Salt of the Earth

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HOOKER CHEMICALS

9-251

SODIUM SULFIDE • SODIUM SULFHYDRATE • SODIUM TETRASULFIDE • CAUSTIC SODA • MURIATIC ACID • PARADICHLOROBENZENE • CHLORINE

WHEN she wants new nylons, she makes a bee-line for the brand she knows. They've always been dainty, smooth-fitting, beautiful. They've never snagged as much as other brands. And she can wash them again and again and again, knowing that each time they'll come out as good as new.

She doesn't know the finish used to give her this satisfactory service. BUT . . . *You* should know that these qualities are the ear-mark of

ETERNALURE

RESIN FINISH FOR NYLONS

And you should also know that besides producing a better finish, which helps sell nylons, ETERNALURE cuts finishing costs in the mill.

It gives body to sheer hose that makes them easier and quicker to handle. It reduces the number of menders because there are fewer pull threads. There are no chalky deposits due to uneven deposition. It involves no changes in operation or equipment . . . no curing . . . no heat treatments.

If you are interested in better selling nylons at lower over-all finishing costs, why not give ETERNALURE a mill-scale tryout? A complete breakdown in the finishing department after such a run will prove its superiority every time.

ONYX OIL & CHEMICAL COMPANY
JERSEY CITY 2, N. J.
CHICAGO • PROVIDENCE • CHARLOTTE • ATLANTA
In Canada: Onyx Oil & Chemical Co., Ltd., Montreal, Toronto, St. Johns, Que.
For Export: Onyx International, Jersey City 2, N. J.

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KNITTING ARTS EXHIBITION
April 25-29

onyx **RESIN FINISHES FOR HOSIERY**

KELTEX EXCELS
FOR DRAPERY GOODS
printed with rapidogens, indigosols
and fast-to-light direct colors . . .
on cotton, viscose and cupra rayon
● Exact and unvarying printing paste viscosity . . . sharp clean printing . . . maximum color penetration and true, even color yield — these are the advantages you get when you use Keltex, the modern algin thickening agent.
Keltex gives equally successful results when used on cotton, viscose and cupra rayon drapery materials . . . with rapidogens, indigosols and fast-to-light direct colors.
With Keltex you eliminate the need for straining or filtering because Keltex is entirely free of grit or other foreign matter. Readily soluble in cold water, it requires no cooking or special handling, and is easily washed out after printing has been completed.
Our Technical Service Department is prepared to cooperate with you fully in adapting Keltex to your particular requirements. Write or call our nearest regional office.
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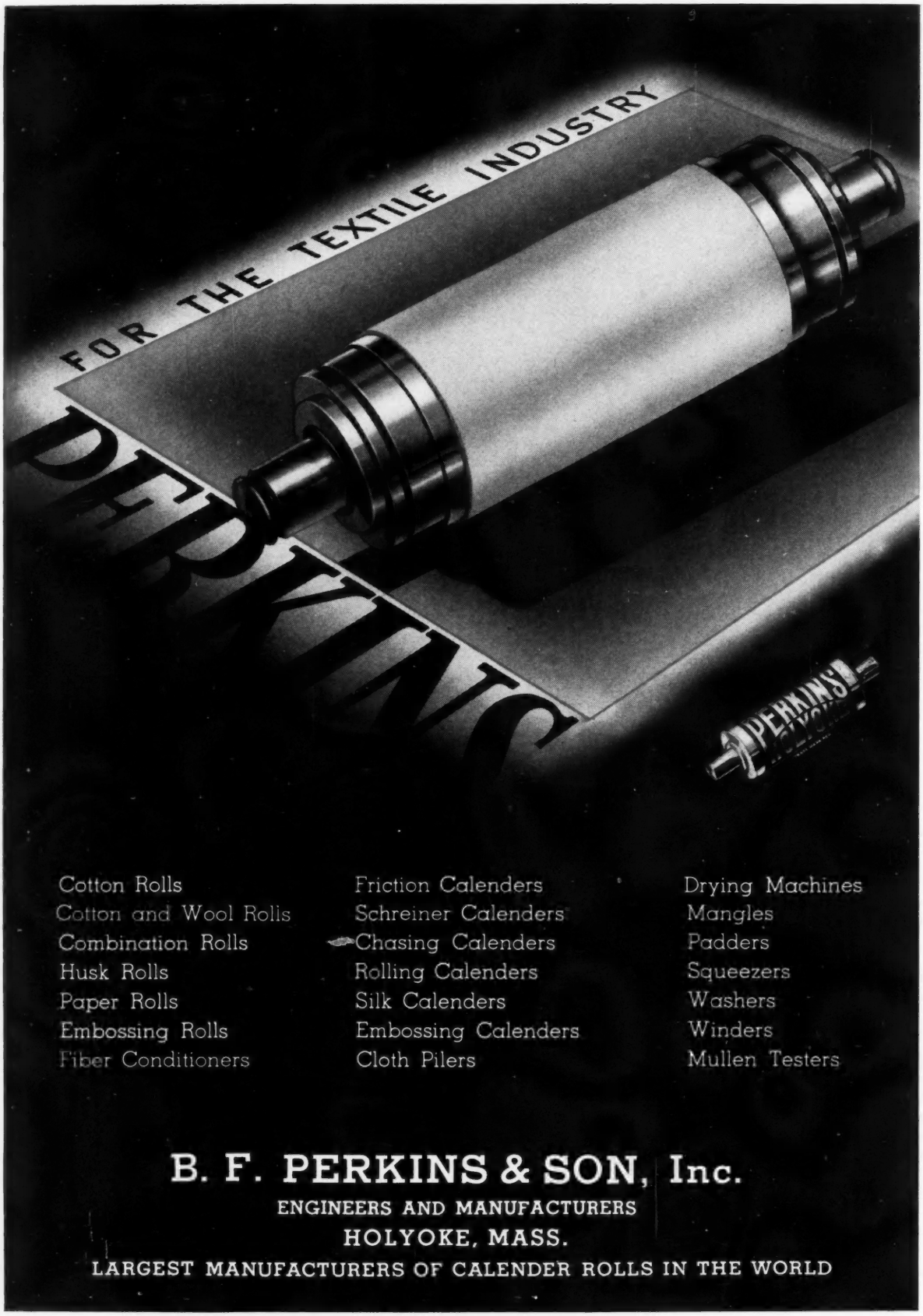

Cotton Rolls
Cotton and Wool Rolls
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Paper Rolls
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Fiber Conditioners

Friction Calenders
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Drying Machines
Mangles
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Washers
Winders
Mullen Testers

B. F. PERKINS & SON, Inc.

ENGINEERS AND MANUFACTURERS

HOLYOKE, MASS.

LARGEST MANUFACTURERS OF CALENDER ROLLS IN THE WORLD

Eastman Acetate Dyestuffs

A wide variety of colors is available in Eastman Acetate Dyestuffs, especially developed for the dyeing of synthetic fibers by scientists who have had long experience in the production of colors for cellulose products. Eastman Acetate Dyestuffs are manufactured under strict laboratory control in a modern plant to assure dyers of uniformly high-quality dyes. The full benefit of Eastman research on dyeing problems is extended without obligation to users of these dyestuffs.

Eastman Acetate Dyestuffs are sold in the United States through Tennessee Eastman Corporation in Kingsport, Tennessee, and Lodi, N. J.; in Canada, through Clough Dyestuff Company Ltd., 33 St. Mathieu Street, St. Laurent, Quebec.

Tennessee Eastman Corporation

—A SUBSIDIARY OF EASTMAN KODAK COMPANY

for DE-SIZING
acetates and acetate-rayon mixtures

Use SERIZYME to safeguard against streaky dyeing . . . to obtain a finer hand . . . to assure uniform quality work.

SERIZYME liquefies protein and albuminous sizes . . . removes them completely.

Technicians available

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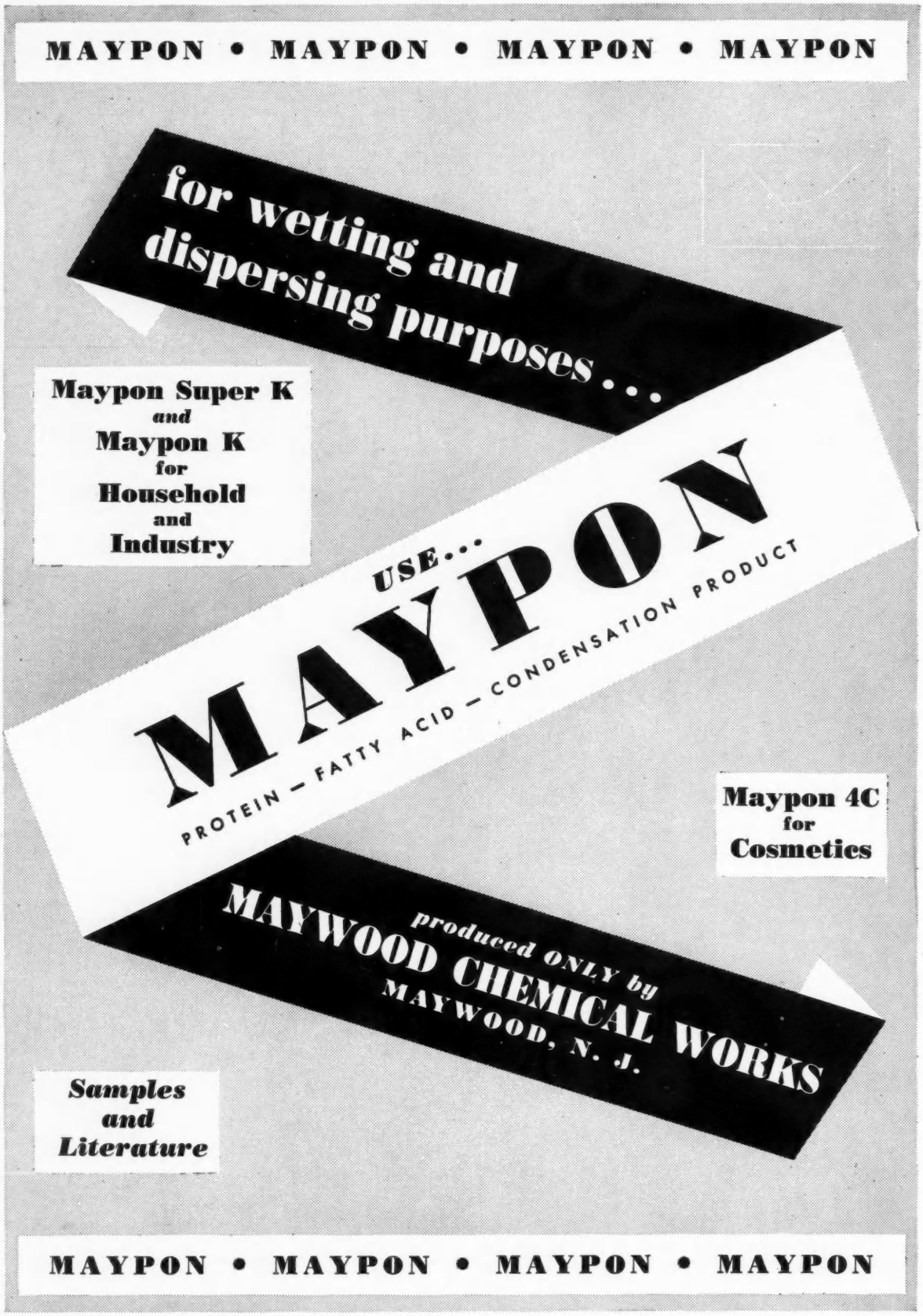
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how SYNERGISTIC ACTION gives you higher detergency at lower costs...

Cleaning power of Santomerse No. 1

Cleaning power of tetrasodium pyrophosphate

Mathematical average cleaning power of Santomerse No. 1 and TSPP

Actual cleaning power of Santomerse No. 1 and TSPP delivered through Synergistic Action

A substantial bonus in detergency is yours at lower cost by employing the synergistic action of two Monsanto products — Santomerse No. 1 and tetrasodium pyrophosphate. *What is synergistic action?* Suppose, for example, you mix Santomerse No. 1, a product of high detergency, with TSPP, having lower cleaning power, you naturally expect effectiveness that strikes an average of the two. Actually, however, the result is detergency higher than the average ... higher than the cleaning power of either product. This co-operation of the two Monsanto products, bringing a bonus in effectiveness, is synergistic action.

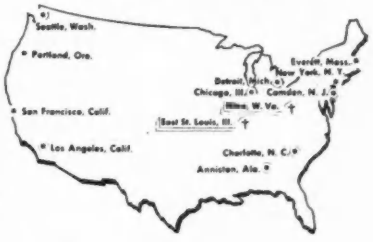
Since TSPP is priced even lower than economical Santomerse No. 1, the use of the mixture lowers your costs while delivering higher detergency.

Look into the possibilities of synergistic action in reducing your costs while increasing the efficiency of your cleaning and scouring operations. For details, contact the nearest Monsanto Sales Office or write: MONSANTO CHEMICAL COMPANY, Desk D, Phosphate Division, 1779 South Second Street, St. Louis 4, Missouri.

DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto (Canada) Ltd., Montreal.

Santomerse: Reg. U. S. Pat. Off.

PROMPT DELIVERY of Santomerse No. 1 or TSPP can be made from the nearest of thirteen shipping points. (*Shipping points; †Producing and shipping points.)



MONSANTO CHEMICALS

MONSANTO CHEMICAL COMPANY
Desk D, Phosphate Division
1779 South Second Street, St. Louis 4, Missouri

Please send, without cost or obligation:_____Data on Santomerse No. 1 and TSPP.

Name_____ Title_____

Company_____

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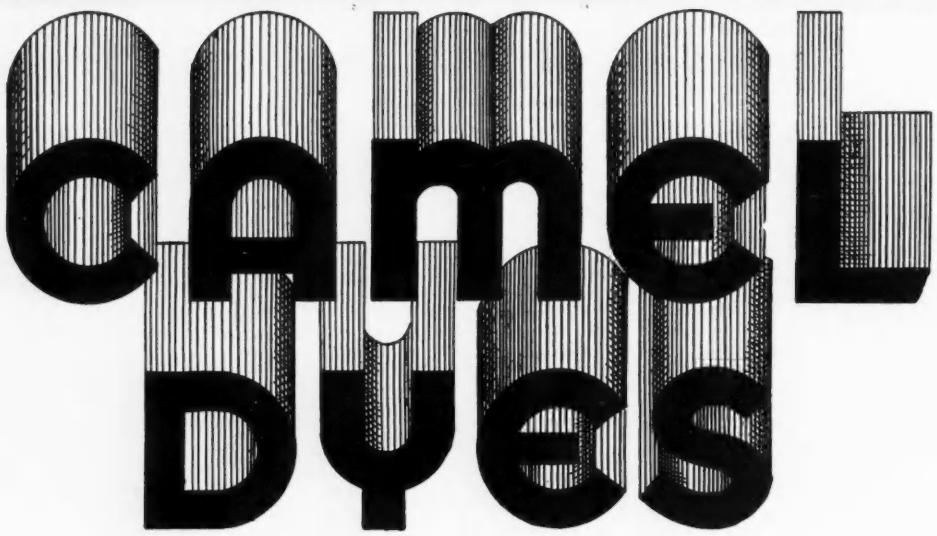

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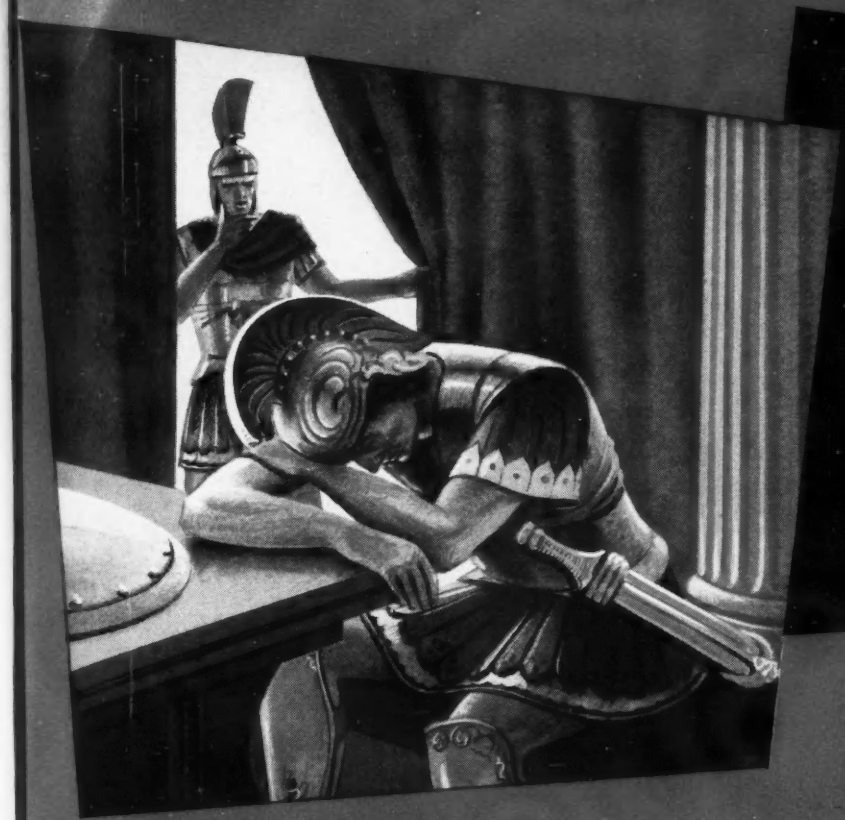

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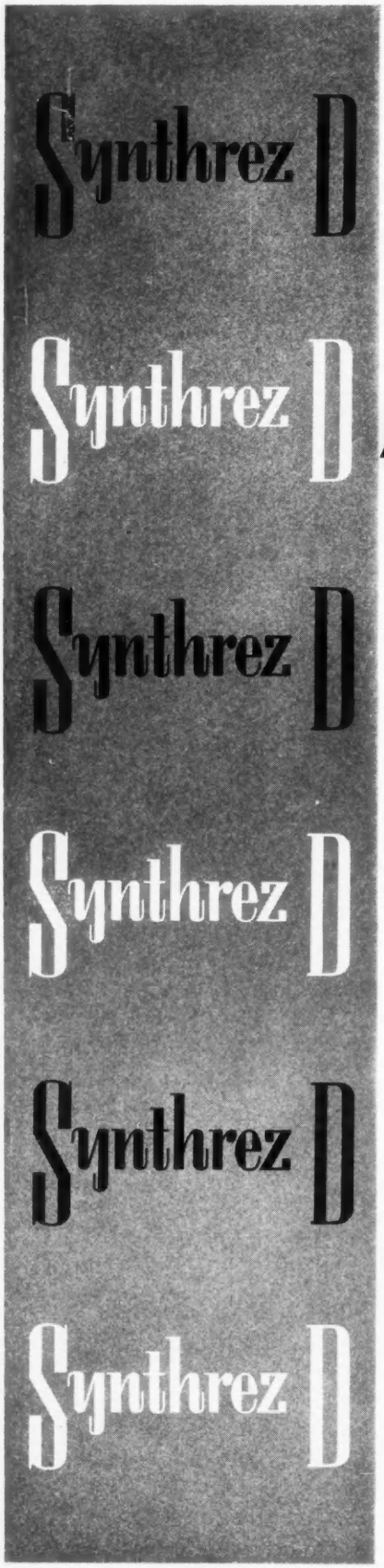

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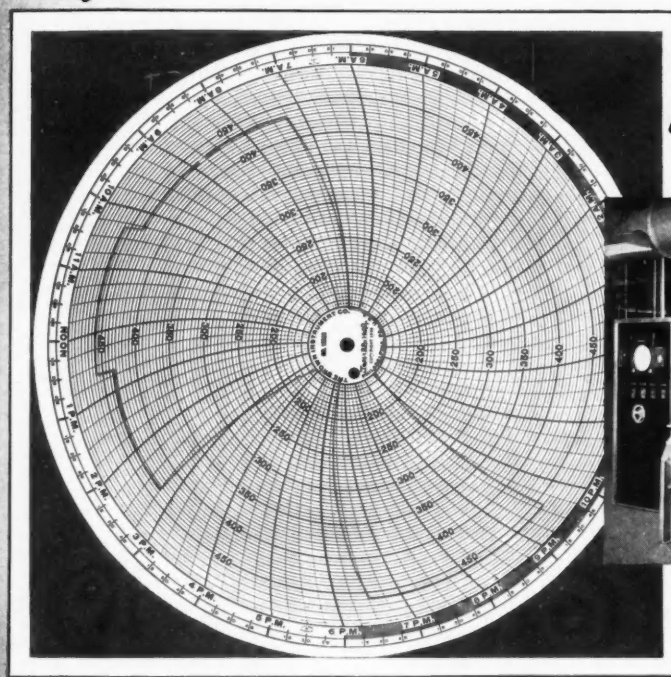

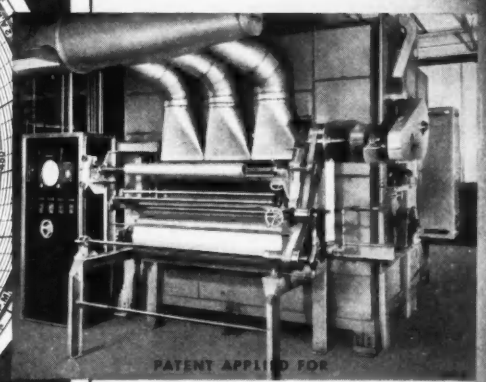

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APRIL 4, 1949
VOLUME 38 NUMBER 7

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VOLUME 38 APRIL 4, 1949 NUMBER 7

QUARTERMASTER CORPS ACCELERATED TEST METHOD

*For Evaluating Shrink-Resistant Wool as Developed for 10½-Oz. Wool Shirting**

LOUIS I. WEINER

Textile Finishing Research Laboratory at the Philadelphia Quartermaster Depot

Foreword

In a previous report (Textile Series Report No. 46) the research and development work of the Quartermaster Corps on the shrink-resistant treatment of Army wool items has been discussed in some detail. As was pointed out in that report, our research in this field is continuing with the aim of further application of shrink-resistant treatments to Army wool items.

The experience gained in the application of a shrink-resistant treatment to socks has indicated that in undertaking treatment of other items it is necessary to make a comprehensive and thorough study of conditions of testing, in order that a satisfactory test method might be developed for evaluating between different types of treatment for ultimate acceptance of goods after they reach the Quartermaster Corps.

While it is recognized that the development of a test method is implicit in the entire problem of shrink resistance as applied to civilian as well as to military uses of wool, there are limiting conditions with respect to the latter which necessitate certain approaches to test methods which are, in a sense, peculiar to military needs. Accordingly, test methods such as have been under consideration for civilian shrink-resistant wool production have not offered a satisfactory solution to our military requirements.

Two of the most important limiting factors on the test methods which we have sought to obtain apply to the need for an accelerated test on the one hand and also one which will correlate with severe field treatment on the other. With these two controlling elements dominant in our consideration, our office has developed in the Textile Finishing Research Laboratory, located at the Philadelphia Quartermaster Depot, a test method which after careful and thorough evaluation has been presented to industry as a basis for submission of experimental fabrics for an improved wool shirting. The principal requirement of this improved fabric is that it shall be resistant to shrinkage under the conditions outlined in this test.

In view of the widespread interest in this problem of testing and its anticipated use in procurement at such time as a military requirement may arise, it has been felt desirable to present a clear picture of the background data on this test method. It is believed that this report will be of interest to the wool textile industry both for its explanation of the basis for the tentative specification for shrink resistance which is under discussion with the industry at this time, and also for its possible assistance in connection with some of the broader problems of shrink-resistant treatments on wool materials as a whole.

It is desired to invite attention to the fact that the work reported upon, which has been carried on over a number of years, has involved the study of every shrink-resistant process for wool known to this office upon which samples have been made available by the producers or developers of the process.

Accordingly there has actually been a great deal of collaboration in this project from many people in industry in the course of this study. Many individuals both in the chemical manufacturing industry and the wool industry have assisted along the way and have contributed very generously of their time in working with us on this study of test methods for wool shrink resistance. Particular reference should be made to the assistance furnished to us by the Textile Foundation and later by the Harris Research Laboratories, under our research contracts with these organizations sponsored by the National Research Council which have been concerned with various fundamental studies on wool and its treatment for shrink resistance.

The work being reported upon herein was performed under the direction of Mr. Louis I. Weiner of the Textile Finishing Research Laboratory, assisted by Mr. John Zimmerman, Mr. Francis Spagna, and Mr. John O'Boyle. In the preparation of this report, Mr. Norman Roberts, Historian of the Laboratory, has assisted.

S. J. KENNEDY,
Research Director for
Textiles, Clothing and Footwear.
September, 1948

SECTION I

Summary

As an outgrowth of research studies on shrinkage-resistant treatments for 10½ oz. all-wool Army shirting, conducted at the Quartermaster Research and Development Laboratories, an accelerated test method has been devised which permits the prediction of the amount of shrinkage in laundering of this fabric. This test has been adopted tentatively after careful study and consideration of the quantitative effects of the many variables which are inherent in testing shrinkage in wool fabrics.

In the test, wool specimens and standard ballast to make a 6-pound load are agitated in 4 inches of water buffered to a pH between 5 and 7 at a temperature of 140°F.

*Textile Series, Report No. 53 Office of the Quartermaster General, Military Planning Division, Research and Development Branch. Released for public information by The Office of Technical Services, U. S. Department of Commerce.

for a period of one hour in a 24-inch Norwood washer. After this the specimens are centrifugally extracted, dried in a tumbler, sprayed and pressed.

A short summary of the characteristics of the test with special reference to its applicability, reproducibility, correlation and recommended performance levels is given below:

1. The test method has been shown to be applicable to practically all of the types of shrink-resistant treatments now commercially available.
2. The test is reproducible within very narrow tolerance limits. Although four specimens per test are recommended it has been found that two specimens per test are adequate for some treated fabrics.
3. A very good correlation has been found to exist between the accelerated test and successive Army mobile launderings for the four different classes of treatments studied. The recommended test has been found to be the equivalent of 20 mobile launderings.
4. Based on consideration of the effect of dimensional changes on the utility of shirts made from treated shirting, performance levels have been set for the warp at not more than 5 per cent relaxation and 4 per cent felting shrinkage and for the filling at not more than 4 per cent relaxation and 3 per cent felting shrinkage on commercially procured fabrics.
5. Analysis of the performance of commercially treated shirting fabric reveals that it will be necessary to have several of the manufacturers advance their processing technology to meet the levels cited.

Other tentative requirements for shrink-resistant wool fabrics include a requirement for ageing, that the hand of the fabric shall not be unduly stiffened by exposure for 100 hours in the Atlas Single-Arc Fade-Ometer. Work is currently under way to establish this requirement based upon a standard testing instrument. There is also a requirement on alkali solubility which is the same as that previously developed for the testing of wool socks, and which is discussed in detail in Textile Series Report No. 46, "Treatment of Army Socks for Shrink Resistance by the Quartermaster Corps."

SECTION II

New Accelerated Shrinkage Test for 10½ Oz. All Wool Shirting

Probably the most widely accepted accelerated test method for evaluating the shrinkage of textile items containing wool is that developed during the war by the Quartermaster Corps for cushion-sole socks. This test procedure is now used in practically all military agencies in this country and in Canada and has been adopted as a tentative standard by the National Association of Hosiery Manufacturers in this country.

In seeking a method for testing the shrinkage resistance of all-wool shirting, consideration was first given to this accelerated test. In studying the procedure, however, several shortcomings became apparent which made it evident that certain modifications would be necessary before it could be applied to shirting. Careful examination revealed that major improvements could be made on the basis of existing knowledge of the effect of laundering variables on shrinkage.

The procedure finally adopted after analysis of the more important shrinkage test conditions discussed later in this report may be summarized as follows:

The test is performed in a 24-inch diameter Norwood washer. The wool specimens and standard ballast are agitated in four inches of water buffered to a pH between 5 and 7 at a temperature of 140°F. for a period of one hour. The specimens are then centrifugally extracted, dried in a tumbler, sprayed and pressed. (See appendix for detailed statement of test method.)

Our office has found it to be a desirable practice, in order to establish proper controls, to obtain separate computations for relaxation and felting shrinkages. The test, therefore, requires that a determination of relaxation shrinkage be made before subjecting the fabric to the above test for felting shrinkage. The suggested relaxation procedure consists of soaking the specimens without agitation in soft water at 80°F. for a period of two hours, after which they are centrifugally extracted, dried in a tumbler, sprayed and pressed. Although the results of the one-hour accelerated test, when used alone will include both relaxation and felting shrinkages as a single value, this figure will be slightly lower than the sum of the two types of shrinkage when measured separately because of the additional tumbler drying involved in the latter method.

SECTION III

Principal Factors in the Determination of This Test Procedure

A. REPRODUCIBILITY OF TEST—In order to evaluate the reproducibility of the new method a series of separate tests were carried out and the validity of the data obtained was analyzed statistically. It was found, as illustrated in Figure 1.

Fig. 1

AVERAGE % SHRINKAGE OF 10½ oz. SHIRTING AFTER LAUNDERING BY THE ACCELERATED TEST

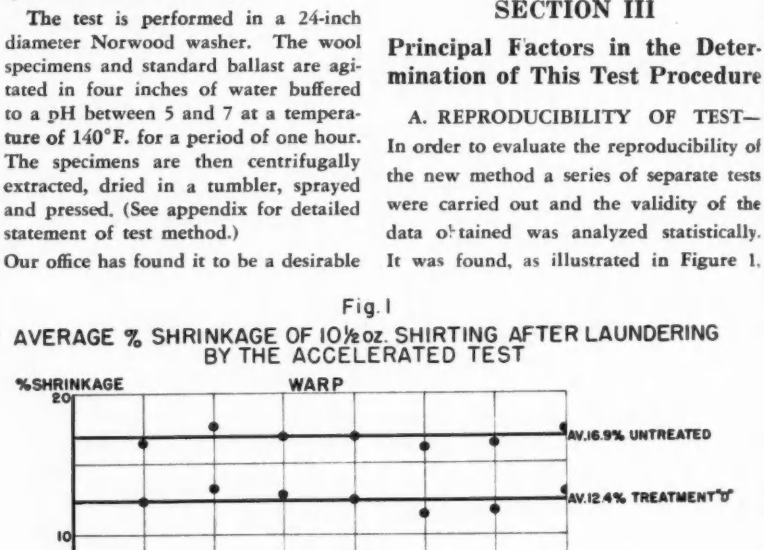
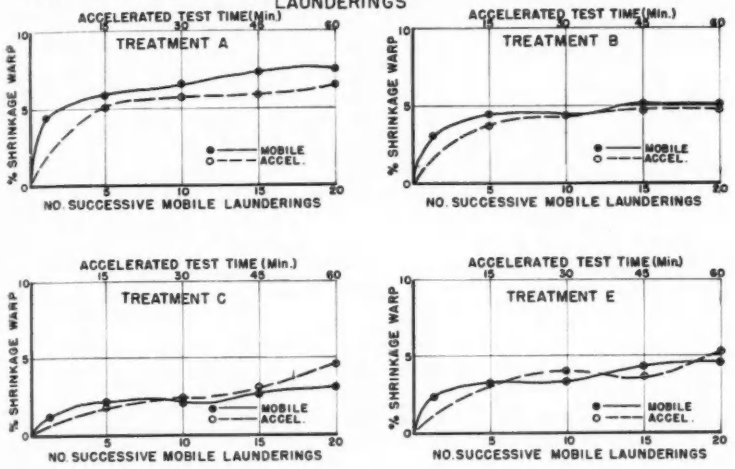


Fig.2
CORRELATION OF THE ACCELERATED TEST WITH SUCCESSIVE MOBILE LAUNDERINGS



that the replicate averages fell within an unusually narrow range.

The good reproducibility of the test results permits the attainment of significant average results with the testing of only three or four specimens per lot. It is interesting to note in Figure 1 that in spite of the slight differences in shrinkage of some of the treatments, in no case does a single average value of one treatment overlap the grand average of another. Likewise it is noteworthy that although the test places the warp shrinkage of treatments A and C quite close numerically it reveals wide differences between their filling shrinkages. This correlates well with the observed behavior of these fabrics in usage. The special precautions and somewhat unorthodox procedures recommended for this test are fully justified by the good reproducibility of results obtained.

B. CORRELATION OF THE NEW TEST WITH SUCCESSIVE FIELD LAUNDERINGS—Establishment of an absolute correlation between a single accelerated test and successive field launderings is a difficult task. Previous work has shown that even when such a correlation is established for one type of finish it will not necessarily apply to another. However, in the particular test which is now recommended more than the usual success has been achieved in obtaining such a correlation, and data obtained show that for as many as four different types of commercial treatments a significant and usable correlation exists.

The data charted in Figure 2 show that for the various treated fabrics the 60-minute accelerated test within reasonable tolerance is almost the exact equivalent of 20 launderings. It is definitely felt on the basis of these data that a fabric which will successfully stand the rigors of the one-hour accelerated test should exhibit adequate stability when laundered in the field and should withstand a minimum of 20 successive launderings before failing.

C. ESTABLISHMENT OF PERFORMANCE LEVELS FOR RELAXATION AND FELTING SHRINKAGE—In an effort to establish realistic rather than arbitrary performance levels for a proposed specification for shrink-resistant shirting, a series of service tests was performed on shirts treated by various commercial processes. This investigation indicates that it was consistent with the present state of technological development in this field to expect that treated shirts should withstand 20 Army launderings before shrinking out of fit. Since the accelerated test produces shrinkage equivalent to this number of launderings, it was considered reasonable to establish as the specification performance level for this test the maximum shrinkage which can occur before a shirt loses its utility.

It has been found, after a study of a large series of shirts made from 10½-oz. shirting, that the garments continue to be wearable until shrinkage of the collar (the first area in which serviceability is affected by excessive shrinkage) reaches 6 per cent. This value, although seemingly high, is correct for this weight fabric in the neckline styling used in Army shirts. It should not be assumed, however, that this value will apply to other types of shirting fabric.

Since the collar is cut in the warp, it is reasonable to expect that the shirts will be wearable up to 20 Army launderings if the warp fabric shrinkage does not exceed 6 per cent in the accelerated test. It is possible to liberalize this requirement further, since as much as 3 per cent relaxation shrinkage is removed during the sponging operation to which all wool cloth purchased by the Army is subjected. Thus an over-all warp shrinkage of 9 per cent has been set as the performance level for 10½-oz. shirting.

For the purpose of quality control it is desirable to indicate how much of this 9 per cent shrinkage should be felting and how much should be relaxation. A figure of 5 per cent has been established as the maximum allowable warp relaxation shrinkage. Three per cent represents that subsequently removed by sponging; the remaining 2 per cent is permitted to compensate for the effect of the tumbler drying which is part of the relaxation shrinkage test. (See Figure 7.) Thus the 9 per cent overall shrinkage is divided into 5 per cent relaxation and 4 per cent felting.*

Since practical experience has shown that shrinkage in the filling direction is always somewhat less than in the warp, filling shrinkage allowances of 4 per cent relaxation and 3 per cent felting have been established.

D. LEVELS OF PERFORMANCE FOR SEVERAL CURRENT SHRINK-RESISTANT PROCESSES—Specimens of shirting treated by a number of commercial shrink-resistant processes were subjected to the accelerated test to determine how realistic the performance levels were in terms of the present state of technological development in this field. The relaxation and felting shrinkages in both the warp and filling directions are shown in Table I. It will be noted that of the seven treatments evaluated in this experiment, only three met the performance requirements with respect to felting shrinkage. However, many of those manufacturers whose products did not secure adequate shrinkage control have expressed confidence that they can reduce the felting shrinkages to a point below the 4 per cent maximum by further improvements in the application of their treatments.

* Relaxation and felting shrinkage are not exactly additive unless they are computed on the same base.

TABLE I
Performance of 10½ Oz. Shirting Treated by Commercial Shrink Resisant Finishes

Treatment	Warp Shrinkage % Relaxation	Felting	
A	2.8	2.8	
E	2.9	3.5	
B	3.1	3.6	
			Spec.
C	0.5	5.7	4%
G	—	8.9	
F	—	9.4	
D	2.1	12.1	
U	4.4	13.0	

Treatment	Filling Shrinkage % Relaxation	Felting	
A	1.7	0.3	
B	0.7	0.5	
E	3.2	1.1	
			Spec.
C	3.1	4.5	3%
G	—	5.1	
F	—	5.3	
D	3.2	8.4	
U	3.2	9.1	

SECTION IV

Variables in Testing Which Affect the Rate of Shrinkage of Wool

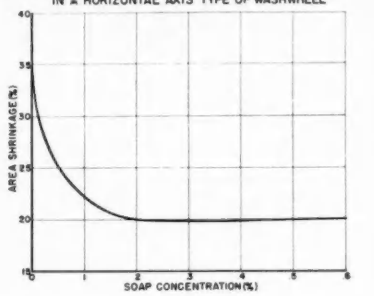
A. DETERGENT—There is a fairly prevalent erroneous belief that felting shrinkage will not take place in the absence of soaps or detergents. That this is not the case is known to those familiar with textile processing who realize that under certain specific conditions (for example, when the wool is fulled in an acid medium) more rapid felting takes place than when soap is used.

Actually, in most conventional washing operations the effect of soap or detergent on the felting rate will depend more on the amount and stiffness of the suds than upon intrinsic differences between the detergents themselves (which appear to play a more minor role). For example, it has been found that in the horizontal types of washers which reciprocate about a horizontal axis—such as the Smith-Drum, the Norwood, practically all commercial washwheels and also home washers such as the Launderall and Bendix — increasing the amount of soap in the washers invariably decreases the amount of felting that takes place. This phenomenon is believed to be the result of the cushioning action of the suds that form above the surface of the wash liquor. When more suds are formed, part of the energy exerted by the fabric or garments dropping to the surface of the liquid during agitation is absorbed by this cushioning by the suds with the result that less felting occurs. Data reported by Carter and Grieves*(1)* for a horizontal-axis type of wash wheel show how an increase in soap concentration up to a certain value causes a decrease in felting. These data are plotted in Figure 3.

The condition indicated by this curve is undesirable from the standpoint of developing a good accelerated test, since high soap concentrations will tend to destroy the accelerated nature of the test and low soap concentrations will cause considerable variation in results due to unforeseen reduction in the strength of the soap and its suds. This latter factor has been one of the causes of variation in the accelerated test for cushion-sole socks which specifies a *running suds,* meaning by implication a low suds system. Accordingly the shrinkages obtained by this test fall along the steep portion of the curve in Figure 3 and thus are subject to significant variation as a result of changes in soap concentrations. Specification of a fixed quantity of soap for each wash load will not help this situation since the presence of titratable acid or alkali or saponifiable oils in the fabric will alter the amount of suds produced and accordingly cause variations in shrinkage.

In view of the fact that in a horizontal

Fig. 3
INFLUENCE OF SOAP CONCENTRATION ON FELTING SHRINKAGE IN A HORIZONTAL AXIS TYPE OF WASHWHEEL



type washer, the presence of soap affects the amount of felting obtained by introducing variations in shrinkage results, it has been concluded that the most effective accelerated shrinkage test for a shirting fabric would be one from which soaps or detergents were eliminated.

When wool shirting samples are laundered in water without any soap being present, shrinkage results of the magnitude shown in Table II are obtained, as contrasted with shrinkages on the same fabrics in the presence of a soap solution.

The above data and those of Carter and Grieves previously referred to appear to show quite clearly that a truly accelerated test which will be reproducible must be carried out in the absence of soap or detergents. It was shown in Section III of this report that an accelerated test performed without detergents can correlate well with successive normal launderings in which a detergent is used.

Two further factors must be taken into consideration when comparison is made between the effect of soap upon shrinkage and that of a synthetic detergent. The first of these is that it is necessary to have definite information as to the sudsing power of a detergent if any conclusion is to be drawn as to its specific effect upon shrinkage. This is clearly evident from the above discussion where it is shown that the amount of felting which occurs in the horizontal type of wash wheel depends more upon the amount and nature of the suds produced than upon inherent differences between the cleansing agents themselves.

In contrast to this situation in a horizontal type washer, it should be noted

TABLE II

Fabric	*Warp Shrinkage %* *Water*	*Soap Solution**
Untreated	16.9	14.2
Treatment D	12.4	11.1
Treatment E	5.8	3.2

* A running suds was used in this test. If more soap were used even less shrinkage could be expected to occur.

that in the more common type of home washer, in which agitation occurs by rotation back and forth about a vertical axis, a different mechanism operates with respect to the action of soap. Since in this type of washer the load is completely submerged beneath the surface of the wash liquor, the degree of mechanical agitation is not affected by the quantity of suds present. In fact, in this type of washer it is more often found that the presence of soap or a detergent actually facilitates the felting process because of a lubricating action which they provide.

Thus, before a general statement can be made regarding the relative properties of soap and synthetic detergent in inhibiting or accelerating felting, careful specification of the type of washing machine used is needed. In addition, definite information is required as to the lathering and lubricating properties of the particular materials to be used.

B. HYDROGEN ION CONCENTRATION—It is well known that hydrogen ion concentration or pH is one of the important factors determining the rate at which felting occurs. Because of the rather wide range of pH's accepted on deliveries of 10½-oz. shirting, it is obvious that this factor could constitute a significant source of variation in the test procedure. Where no detergent is present, the rate of felting is highest in the low pH (acid) regions, and lowest in the high pH (alkaline) regions. The rate of change of the curve is most rapid in the alkaline and acid regions and slowest in the neutral region. A typical curve relating felting and pH is shown in Figure 4.

Examination of this curve shows that it might be advantageous from the standpoint of accelerating the test to operate at low pH's. However, since the specimens can be handled more easily in neutral solutions and since greater reproducibility is obtainable in the neutral portions of the curve by reason of the slower rate of change in this region, it has been found advisable to specify that the test be conducted in a pH range of from 5 to 7. This range can be easily maintained by the use of standard buffer solutions.

C. TEMPERATURE—Conflicting data have been reported in the literature regarding the effect of temperature on felting. Data reported by Speakman, Stott and Chang*(3)* suggest that temperature variation in milling causes little if any change in shrinkage between 100° and 130°F. However, more recent data on untreated wool reported by Carter and Grieves*(1)* covering temperatures from 70° to 150°F. and on treated wool, as reported by the Quartermaster Textile Finishing Research Laboratory from 100° to 140°F. show that increasing the temperature sig-

Fig. 4
EFFECT OF pH ON FELTING SHRINKAGE[2]

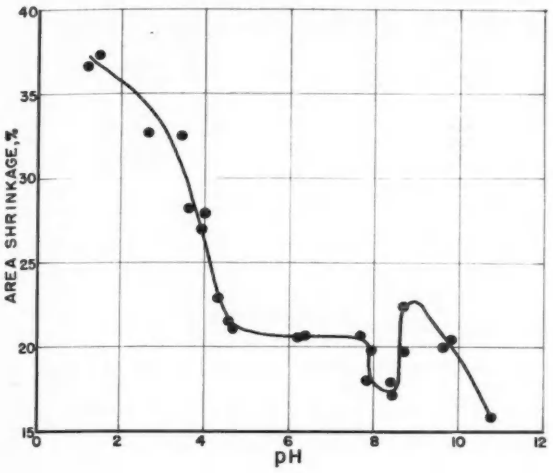
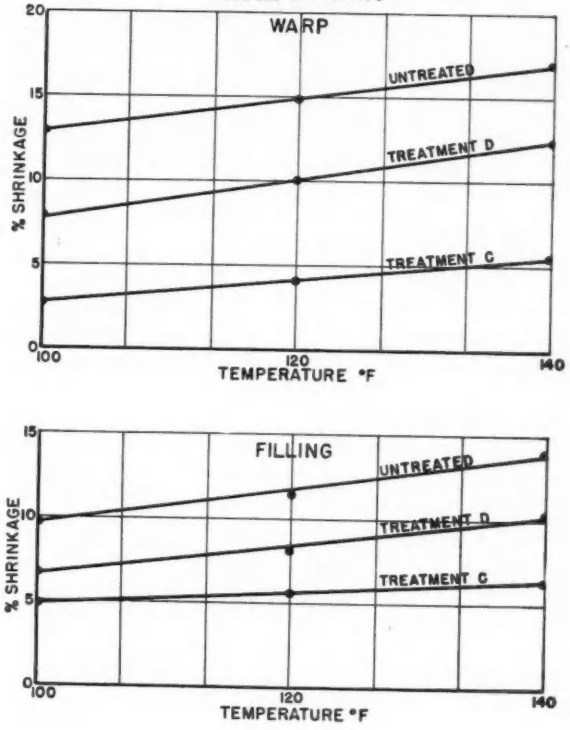


Fig. 5
EFFECT OF TEMPERATURE ON SHRINKAGE OF 10½ oz. SHIRTING



nificantly increases felting where the material is agitated in a horizontal wash wheel. Data for both warp and filling shrinkage are shown graphically in Figure 5.

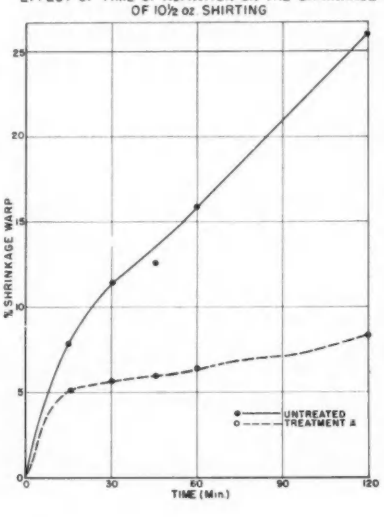
This chart shows a definite increase in shrinkage at temperatures up to 140°F. This, plus the fact that under field laundering conditions proper control of temperature is not always possible, led to the establishment of a 140°F. temperature for the accelerated shrinkage test on socks, which was adopted during the war. Since that test came into use, continuing studies as well as routine acceptance tests have shown no evidence that the wool was being damaged at that temperature. On the other hand we have found excellent correlation between our accelerated test at 140°F. and successive mobile launderings at 100°F. as is pointed out above.

D. NATURE OF LOAD—Variation in shrinkage has been claimed to result from indiscriminate use of various types of ballast. If a ballast composed of untreated wool is used its character changes with frequent use due to felting. If soap residues are allowed to remain in the ballast they may produce undesirable sudsing in subsequent tests. The size of individual specimens comprising the ballast also affects the end results. It has been found that wool will felt more rapidly when laundered with a wool ballast than with a cotton ballast of corresponding weight.

In our newly developed accelerated shrinkage test it has accordingly been determnied that the ballast should consist of shrink-resistant treated wool swatches of the same size as the test specimens. It is necessary to inspect the ballast carefully to make sure that it has not previously been contaminated with soap or synthetic detergent. At the expiration of fixed intervals the ballast should be re-examined and replaced if evidence of felting is found.

E. TIME OF AGITATION—It is in the interest of economy in laboratory operations to keep accelerated tests as short as possible. In Figure 6 is shown the relationship between warp shrinkage and time of agitation. On the basis of this chart it was determined that one hour is the minimum time which can be used safely in accelerated tests to show major differences in shrinkage. In addition, it was found that a better and mor consistent correlation between this test and successive mobile launderings could be obtained in one hour than in the longer test periods.

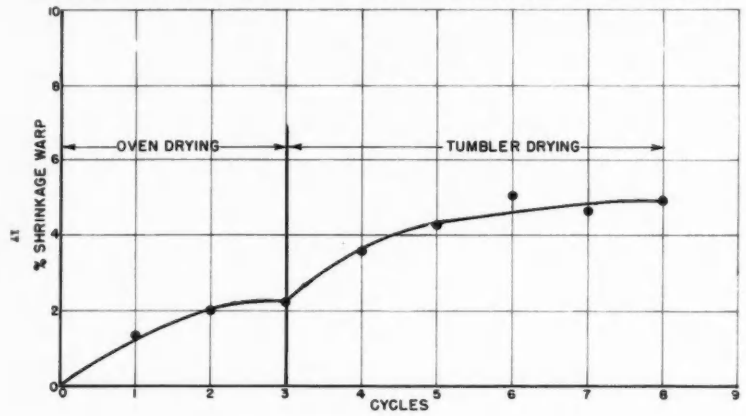
Fig. 6
EFFECT OF TIME OF AGITATION ON THE SHRINKAGE OF 10½ oz SHIRTING



F. METHOD OF DRYING—Another serious cause of variation in testing the shrinkage of fabrics is introduced in the drying operation. Practically all current Government and commercial test methods require that woven fabrics be dried in an oven followed by spraying and pressing. For material purchased by the Armed Services such a provision is inconsistent with the actual method of drying generally used in field laundry practice. Under field conditions garments made from 10½-oz. shirting will be dried in a tumbler, since this will normally be the only equipment available. On the other hand, in post laundries it may be expected that when standard methods are set up for handling washable wool shirts, drying will be accomplished in a tumbler followed by pressing on a tailor's press.

Laboratory analysis of this problem has revealed that considerably more shrinkage occurs as a result of tumbler drying than oven drying, and accordingly it is felt more realistic to include a provision for

Fig.7
EFFECT OF CYCLIC WETTING & DRYING ON THE SHRINKAGE OF 10½oz. SHIRTING



the former procedure in the test method. In one series of tests it was found that successive cycles of wetting and oven drying (carried out so as to avoid felting) did not eliminate all of the mechanical or relaxation shrinkage of the shirting. This latter effect is achieved only where tumbler drying is resorted to as shown in Figure 7. Other tests on both wool and cotton fabrics have revealed that more uniform shrinkage is obtained by using tumbler drying since less manual handling of the specimens is involved.

SECTION V

Other Tentative Specification Requirements

In addition to the major aspect of our tentative specification on a shrink-resistant treated fabric, which has been discussed above, two other important specification requirements, alkali solubility and ageing, are contemplated.

It is recognized that the alkali solubility test provides a satisfactory means for determining the chemical effect of certain types of shrinkage-resistant treatments upon a fabric. Its reliability has been amply demonstrated as a control test in the chlorination of wool under procurements of socks by the Army during the war.

In the tentative specification requirement a 6 per cent increase in alkali solubility is permitted for this treated fabric, whereas only 3 per cent was allowed in the case of the cushion sole socks. This relaxation in requirements is made pending the introduction of greater improvements in commercial techniques in treating fabrics of this type.

The necessity for an ageing test will be clearly evident when one considers the frequent requirement for long-term storage of military items under adverse temperature conditions. While none of the current treatments recommended by the industry appear, when properly applied, to result in a decrease in fabric strength under long-term storage, there is a tendency for some treatments to exhibit harshness or for the fabrics to stiffen appreciably upon long-term ageing.

The test currently contemplated is now simply a visual and tactile inspection of the material after 100 hours' exposure in the Atlas Single Arc Fade-Ometer. There is now under development a test method requirement for the stiffening of fabric on ageing based upon a standard testing instrument.

APPENDIX 1

A detailed outline of the new accelerated shrinkage test is given below. Before performing this test the sample shall be relaxed in accordance with the procedure previously described. Where the relaxation procedure is used the felting shrinkage shall be based on the dimensions of the relaxed specimens.

TEST SPECIMENS—Four 24 x 24-inch specimens marked in the warp and filling directions in accordance with the procedure outlined in Federal Specification CCC-T-191a, Section XIV, Paragraph 1a shall be used.

MACHINE — The washing machine shall be a standard rotary reversing type (described in Federal Specification CCC-T-191a, Section III, Paragraph 5f), having a cylinder which measures 24 inches in diameter by 24 inches in length. Other sizes of laundry machines may be used provided they are calibrated to give the same results as the standard washer at the laboratory of the procuring agency.

PROCEDURE—Water at 140°F., and of not over 50 p.p.m. hardness, shall be entered into the machine until it reaches a level of four inches above the bottom of the inside cylinder. The water shall be buffered to a pH between 5.0 and 7.0 using a suitable buffering agent. The specimens to be tested and clean ballast (composed of detergent-free treated wool flannel cut to 24 x 24 inches) to make a six-pound load are placed into the water and the machine is put into operation and agitation allowed to proceed for a period of one hour.

The temperature of the water in the washer shall be maintained at 140°F. during the entire cycle. At the end of this period the specimens shall be centrifugally extracted for five minutes at a speed of 1575r.p.m. and dried in a tumbler-drier at a stack temperature of 130°F. for 30 minutes. The tumbler drier shall consist of a cylinder having an inside diameter of 36 inches and a length of 24 inches and shall rotate at a speed of 35 r.p.m. Other sizes of tumbler driers may be used provided they are calibrated to give the same results as the standard drier at the laboratory of the procuring agency. After drying the specimens shall be sprayed, pressed and conditioned before measurement for not less than four hours at a standard atmosphere as described in Federal Specification CCC-T-191a, Section II.

MEASUREMENT OF SHRINKAGE—After reaching equilibrium in the standard atmosphere the specimens shall be measured and the shrinkage computed in accordance with the procedure outlined in Federal Specification CCC-T-191a, Section XIV, Paragraph 1h. Measurements shall be taken to the nearest 0.1 of an inch and shrinkage or elongation shall be reported to the nearest 0.1 of a per cent. Elongation shall be reported prefixed with a (—) minus sign.

APPENDIX 2

A statement of the test methods and tentative specification requirements for alkali solubility and ageing, as abstracted from the proposed specification for "Cloth, Wool, Flannel, All Wool, 10½ Ozs., O.D., Shrink-Resistant Treated," are given below:

ALKALI SOLUBITY—*Scope*—This test shall be used for determining the total alkali solubility and the change in alkali solubility of the wool top, yarn or fabric, whichever has been subjected to the chemical treatment. The test shall be conducted according to the procedure described below:

Test Specimens—For this determination, four treated and four untreated samples shall be used from the same production lot. From each sample, a specimen weighing 1 gram (± 0.1 gram) shall be cut for test purposes.

Test Procedure—The alkali solubility test procedure outlined in the Supplement to Federal Specification CCC-T-191a, Section VII, Paragraph 3a(3) shall then be followed, wherever applicable.

Requirement—If a chemical method of producing shrink resistance is used (e.g. chlorination), the alkali solubility of the material after treatment shall not be increased more than 6 per cent (absolute) over the untreated material.

AGEING—A specimen of the finished cloth approximately 2 inches wide and 4 inches long shall be exposed in an Atlas Single Arc Fade-Ometer for a period of 100 hours with the face of the fabric exposed to the source of radiation. At the end of this time, the specimen shall be removed and conditioned in a standard atmosphere for a period of 4 hours.

Requirement—When submitted to this test, the fabric shall not harshen or stiffen excessively.

References

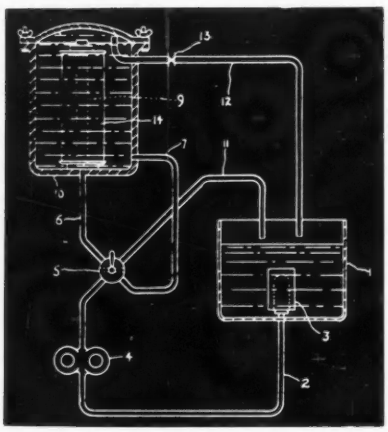
1. E. Carter and W. Grieve, Wool Industries Research Association, Special Publication No. 6, October 1944.
2. Speakman and Menkhart, Journal of Society of Dyers and Colourists, January 1948.
3. J. Speakman, E. Stott, H. Chang, Journal of the Textile Institute, July 1933.

• PATENT DIGEST •

Dyeing Apparatus for Package Dyeing C, 6

Brit. Pat. 597,733 (British Celanese, Olpin-Wesson, February 2, 1948)

It is well known that the dyeing methods of dispersed, water insoluble acetate dyestuffs which are successfully used in dyeing acetate rayon fabrics on the winch or on the jig, give bad results in package



Brit. Pat. 597,733
Dyeing Apparatus for Package Dyeing

dyeing. It has frequently been observed that the packed material, for instance bobbins, act as filtering media. Thus the outside layers absorb the dispersed dyestuff pigments while the inner layers are less colored or not colored at all. Reversing of the direction in which the dyebath penetrates the textile body does not help very much. Large amounts of dispersing agents can improve the results but in dyeing mixtures of dyestuffs it can be observed that the ratio of absorption does not correspond to the initial proportion of the single dyestuffs contained in this mixture; in other words some of the dyestuffs were absorbed at a higher speed than the others. The present patent solved the problem in a very simple way: a candle filter (3) is placed in the dyebath reservoir (1) on top of the pipe (2) which leads to the dyeing apparatus; by turning the valve (5) in different ways the dye liquor can be either pressed through the bobbin (14) in one or the other direction or brought back to reservoir (1) by pipe (11). The filter, being the main feature in this invention, is characterized by the size of the pores, preventing a passage of particles having a dimension in excess of 0.0005 mm.

PAUL WENGRAF

Pigment Printing—Combined With Reductive Discharge D, 2, 02

Brit. Pat. 598,260 (S. A. Francolor, February 13, 1948)

Pigment printing pastes consisting of oil-in-water emulsions or of water-in-oil emulsions are generally known for their good effect in application printing on white fabrics but they do not sufficiently cover a predyed ground to substitute discharge effects. It has been tried to incorporate one of the usual discharging agents, for instance sodium formaldehyde sulfoxylate or other dyestuff destroying product (also some of the oxidizing group) into the aqueous phase; but it was not possible up to now to concentrate a sufficient amount of these products in the printing paste to obtain satisfactory results; moreover, these agents are composed of electrolytes, breaking in time the emulsions. Therefore the pastes lacked stability. It has been observed that even considerable amounts of discharging agents can be introduced into emulsions of pigment printing pastes by adding the reducing substance in form of a protective colloid solution for instance a thickened hydrosulfite, formaldehyde sulfoxylate and the like. The protective colloid may be one of the usual thickeners such as gum, starch, alginate, polyvinyl alcohol and so on. The emulsions are produced, according to British Pat. 570,742 of the same company, on the base of glycerophthalic resins, modified with a fatty oil (soy bean oil), ground with a red pigment ("Lutetia Scarlet NRF") which is pasted with white spirit. On the other hand sodium formaldehyde sulfoxylate is dissolved in a gum tragacanth mucilage and homogenized with the first mentioned resin emulsion by stirring. The paste is printed on a fabric dyed a dark blue with a dischargeable polyazodyestuff; bright red effects on marine ground are obtained after aging. Analogous examples are given for pastes containing Monastral green and titanium white.

Reference is made to U. S. Pat. 2,017,120 (Celanese): zinc salts of vat dyestuffs are used as insoluble pigments and combined with an alkaline zinc formaldehyde sulfoxylate discharge paste. But this patent has only a slight analogy with the present invention because pigment printing with this kind of emulsion was not yet known at the time of the issue of the Celanese patent (1935).

Sizing—Starch Mixed with Etherifying or Esterifying Agents A, 4, 01

U. S. Pat. 2,451,686
(W. A. Scholtens Chem. Fabrieken, Moeller-Lolkema, October 19, 1948)

A dry composition, readily dispersible in water to a transparent paste, can be prepared by mixing cold soluble starch and an esterifying or etherifying agent and pouring the dry mixture into slightly alkaline solutions. Upon contacting this mixture with water the cold swelling starch, which is very reactive, undergoes immediately etherification and a viscous paste results which can readily be used for sizing and thickening purposes. Apparently the use of starch ethers or esters has some advantage in comparison with simple cold swelling non-etherized starch.

Examples are given comprising the application of sodium monochloroacetate or sodium bromoethane sulfonate as esterifying and of dimethyl sulfate or dichlorodimethyl sulfate as etherifying agents. One of the examples teaches preparing a batch of dry cold swelling tapioca starch mixed 1:0.23 with diethyl sulfate and another batch of tapioca starch, suspended in soda lye and dried. These two batches are stirred together. The composition added to water gives a partly etherified starch paste. The cold swelling starch can be produced according to any one of the known methods. The specification mentions especially heating the starch for a short time in the presence of small amounts of water to temperatures above the gelatinization point, thereupon pressing the mass into a thin layer which is subsequently reduced to powder form.

References, cited by the Patent Office, among others:

U. S. Pat. 504,178, 1924 (Young) gives the original method of preparing starch ethers by treating starch, dextrine or the like (cold swelling starch not mentioned) with alkylating agents to form water insoluble products upon heating.

For other references see AM. DYEST. REPORTER 1947, 337, relating to U. S. Pat. 2,412,213 (Groen).

Chrome Dyestuffs Printing—Paste Containing Neutral Chromates, Accelerator and Anthraquinone D, 2, 05

U. S. Pat. 2,456,471
(Durand & Huguenin, Tschan, December 14, 1948)

As well known, the customary chrome dye fixing method by long steaming procedure was disliked, especially when the dyes had to be printed alongside readily fixable dyestuffs such as vats, Indigosols and naphthol dyes. This drawback could be somewhat overcome by different auxiliaries such as urea, formaldehyde and acetamide. The specification here quotes a study published by G. von Niederhäusern and the French Pat. 865,067. Progress was also made by using neutral chromates instead of other chromium salts to which reducing agents were added. Nevertheless it was necessary to age the prints for a considerable time. The present invention suggests applying for this purpose a special dye printing composition, partly consisting of ingredients other than used in the prior art. The paste contains (besides the dye and the thickener):

an amide (preferably urea),

an accelerating agent (dihydroxy diethyl sulfide),

a latent acid developing agent (ammonium chloride),

a neutral chromate solution (sodium or ammonium chromate),

a reducing salt (thiosulfate or hydrosulfite) and

a poly hydroxy compound, capable of performing a reversible oxydation—reduction reaction (anthraquinone).

Examples of dyestuffs used in this process are Chromocitronine R, Chrome Violet CB and other products of this group. It is remarkable that steaming can either be completely omitted or at least substantially accelerated. In any event, hanging in the open air, can drying or storing over night will be sufficient for developing the full, fast shade.

Reference: The patent may correspond in basic principles to Swiss patent 247,429 (A.D.R. 1948, 538) but some details are added which are essential for understanding the method.

Chrome Dyestuffs Printing—Salts of Di- or Trivalent Metals Added D, 2, 05

U. S. Pat. 2,454,623
(Geigy. A. G., Babey-Stocker, November 23, 1948)

Textile printing pastes, containing chrome dyestuffs, chrome mordant and natural gums, harden after printing thus giving a harsh hand to the printed material. It has been discovered that this disadvantage can be avoided by adding di- or trivalent metal salts which do not form insoluble metal salts in chromate containing textile printing colors of the usual composition. Thus the printing paste consists principally of a chrome dyestuff (for instance Chrome Azurol S), thickener, urea and acetic acid. To this composition *a complex zinc chromate,* obtained by adding zinc sulfate, to sodium dichromate and subsequently precipitating with ammonia, is admixed. The precipitate has approximately the ratio Cr:Zn: NH_3 = 3:2:2. Fabrics printed with this paste show a soft hand after steaming, washing and drying. Similar complex mordants are produced by using caustic soda or potash lye as precipitating agents, further by replacing the zinc salt by soluble salts of Mg, Ca, Cd or Al.

References cited by the Patent Office, among others:

U. S. Pat. 1,848, 589 (Durand & Huguenin): urea is added to normal chrome dyestuff printing pastes.

U. S. Pat. 1,942,774 (Durand & Huguenin): chrome dyestuff printing pastes contain urea, thiocyanate, glycerol but no di- or trivalent metal salts.

AM. DYESTUFF REPORTER 1936, 613: an article written by T. C. Hutchins mentions the use of pastes containing the chrome dyestuff but omitting the mordant. It is stated however that in this event shades of inferior fastness only are obtained while in the present invention chrome salt is added to the paste although in a quite different form.

Permanent Finishes—Cellulose Etherified with Unsaturated Chains G, 2, 01

U. S. Pat. 2,455,083
(Pacific Mills, Musser, November 3, 1948)

The main object of the present invention is to impart true permanent finishes to cellulosic material. While crush resistance, water repellence, softness and so on, being durable to some extent to laundering have been achieved, especially by incorporating resin condensates into textile goods, these finishes are not able to withstand repeated washing, etc., operations according to the preamble of the specification. A truly permanent finish could only be accomplished by a chemical reaction of the finishing substance with the cellulosic fiber itself, for instance by applying products linking with free OH groups of the cellulose molecule. The invention propagates the new idea of producing a cellulose derivative containing a double bond in close proximity to the hydroxy groups of the cellulose. Such a double bond derivative may be obtained by reacting alkali combined cellulose fabrics with an *epoxy alkene,* i.e. an unsaturated epoxide, for instance epoxy butene: $CH_2 = CH—CH—CH_2$ (with O bridging the last two carbons).

The final product has the schematic formula: Cellulose — OCH_2—CHOH—CH: CH_2. It can be seen that the very reactive double bond is firmly linked to the cellulosic molecule. This method gives the opportunity of either adding hydroxy-containing groups to increase wettability or to add long chains to obtain permanent water resistance or other durable permanent finishes as desired according to the nature of the compound reacting with this modified cellulose.

References cited by the Patent Office, among others:

U. S. Pat. 2,238,949 (Duisberg): describes a material containing an amino or imino radical such as wool or imine-treated viscose which is reacted with isopropyl urea to form groups, having an increased basicity.

U. S. Pat. 2,164,248 (Imp. Chem. Ind.): a sheet of cotton cloth is alkylated superficially with ethylene oxide in the presence of alkali. The goods are washed free of the reagents and this sheet is joined to another sheet of ordinary cellulose fabric by heat and pressure.

U. S. Pat. 2,131,145 (I. G. Farben): the reactivity of wool or other proteinaceous fibers is increased by treating with alkylene oxide, alkylene imine or alkylene sulfide.

(Concluded on Page 320)

Proceedings of the

American Association of Textile Chemists and Colorists

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April 4, 1949

Meeting, New York Section

A MEETING of the New York Section was held on Friday evening, March 4th, at the Hotel New Yorker, New York. An informal dinner preceded the meeting.

Charles W. Dorn, Chairman, presented Henry F. Herrmann, National President, who paid tribute to Dr. Louis A. Olney with the following remarks:

* * * * *

TRIBUTE TO LOUIS A. OLNEY

I have been asked to come here tonight to talk about the passing of our friend Dr. Olney. There is such a thing as the heart being so full that you don't know where to start. That is about the way I feel.

There is much to be said, but so much has been said, that it doesn't have to be repeated.

Undoubtedly you have all read the fine biography of Dr. Olney that appeared in the February 21st issue of the *American Dyestuff Reporter*. It was very well done and portrayed a beautiful and useful life. It revealed many facets of our old friend that even those who were close to him didn't know. I added a few words in tribute. I don't want to repeat what I said. Those things don't come easily and need not be said again.

Quite a few of your associates in the A.A.T.C.C., friends of Dr. Olney, traveled to Lowell in order to attend his funeral rites. You might be interested in a little description of what transpired.

It was nothing dramatic. It was just the passing of a man who was loved by many hundreds and so hundreds flocked to his church and many stood around outside who couldn't get in. There was one full congregation in the church proper and another one apparently just as large in the lower floor. After the services were over, those people from down below and outside streamed up two by two, two by two, two by two, and it seemed as if there were a thousand of them who went up to the front of the church to pay their last respects to Dr. Olney and his wife.

There were the biers carrying the two gray, closed caskets, surrounded with thousands of flowers. They must have stripped all of Lowell and Boston to make that floral display.

All this time the organ was playing, not an imposing march funebre, but simple songs of the heart, appropriate to the type of man he was, and apparently the sort of music that his friends knew he would like for that occasion.

There was an elderly gentleman standing alongside of me, one of the honorary pall bearers, who said in a whisper, "How do you like our organ?" I had been listening to it and admired its tone. I said, "It is a lovely instrument. What about it?"

"Well," he said, "it is only a few weeks old. I thought I would mention it to you as we have Dr. Olney to thank for this organ. It is the latest type electronic instrument with 2200 tubes in it."

I said, "Dr. Olney, seventy-four years old, a conservative gentleman, would think of buying something as new and modern as that?"

He replied, "Yes, yes. That is the way Dr. Olney was."

I then said, "Did he mean much to this church?"

The gentleman turned around and looked squarely at me and said, "He was this church. He and his wife were the pillars of this church. When something important had to be done they could always be counted on to do it."

I mention this because those of us who knew him thought of him only as the pillar of the A.A.T.C.C.

There were hundreds of students present. I went to the Lowell Textile Institute and there were thousands there who might have said he was the pillar of the school.

So we find this man of many sides, many facets, who lived and worked in his quiet way and endeared himself to so many and who has left a deep imprint on this generation.

Of what I said in my tribute, this is the only portion I wish to repeat: "As long as there is an A.A.T.C.C., so long as there is an Olney Medal, and so long as our name survives, it will carry with it his name. I am going to ask the Council to vote him the title of 'Founder', to accompany 'President Emeritus', of the American Association of Textile Chemists and Colorists, so that the name of Louis Atwell Olney will never be forgotten."

We owe him a great debt of gratitude. I think Dr. Olney would feel badly if I were to imply that he alone founded this Association. He wouldn't want me to say that. It wasn't true, but he was the leader, and praise God for that leader!

* * * *

Following Mr. Herrmann's remarks, the members arose for a minute of silent tribute to Dr. and Mrs. Olney.

Chairman Dorn announced that the New York Section would be host for the 1951 National Convention and that reservations had been made at the Hotel Statler for October 18, 19 and 20.

A. W. Staudt, Manager, Nylon Technical Service, E. I. du Pont de Nemours & Co., Inc., presented a paper entitled "The Element 'X' in Nylon". Following Mr. Staudt's address the sound color film "This is Nylon" was presented.

The attendance was 325.

Respectfully submitted,
NORMAN A. JOHNSON, *Secretary.*

CALENDAR

WESTERN NEW ENGLAND SECTION
Meetings: April 8, May 20.

NEW YORK SECTION
Meeting: May 6.
Outing: June 17.

PHILADELPHIA SECTION
Meetings: April 22, May 20, September 16, November 11 (Kugler's, Philadelphia).
Outing: June 10.

PIEDMONT SECTION
Meetings: June 24, 25, 26 (Ocean Forest Hotel, Myrtle Beach, S. C.). November 5 (Charlotte Hotel, Charlotte, N. C.)

HUDSON-MOHAWK SECTION
Meetings: May 20, September 16, November 18.
Outing: June 17.

PACIFIC COAST SECTION
Meetings: May 13 (Los Angeles); May 17 (Portland).

RHODE ISLAND SECTION
Meeting: April 22.

SOUTHEASTERN SECTION
Meeting: April 23 (Ralston Hotel), Columbus, Ga.).

COUNCIL
Meetings: June 9, Sept. 9, Dec. 9.

RESEARCH COMMITTEE
Meetings: June 9, Sept. 9, Dec. 9.

NATIONAL CONVENTIONS
1949: October 13 to 15, Chalfonte-Haddon Hall, Atlantic City.
1950: October 19 to 21, Statler, Boston.
1951: October 18 to 20, Statler, New York.

Rhode Island Section to Meet April 22nd

THE next meeting of the Rhode Island Section is scheduled for April 22nd with an informal dinner at the regular time at the University Club.

There will be two speakers for this meeting as follows:

Harold E. Huber, Girdler Corp., "A New Method and Apparatus for the Continuous Production of Vat Pastes and Printing Gums".

Jackson A. Woodruff, American Viscose Corporation, "Direct Dye Selection".

In addition a movie, "The Story of Milliken Woolens" will be shown.

—♦ ♦—

Philadelphia Section Meeting Date Changed

THE date of the next meeting of the Philadelphia Section has been changed from April 15th to April 22nd.

—♦ ♦—

Philadelphia Textile Institute Student Chapter

AT a recent meeting of the Philadelphia Textile Institute Student Chapter, Dino D. Cimma of the Interchemical Corporation, Textile Colors Division, presented a film entitled "Pigmented Emulsions in Textile Printing," and showed samples of such colors on a variety of fabrics, both roller and screen printed.

Respectfully submitted,
DORIS McALLISTER, *Secretary.*

—♦ ♦—

National Intersectional Contest Committee

PATRICK J. KENNEDY, Chairman of the National Intersectional Contest Committee, announces the following members of his committee for the 1949 Contest:

J. ROBERT BONNAR
Technical Director, General Dyestuff Corporation, New York

FRANK J. O'NEIL
Physicist, Pacific Mills, Worsted Division, Lawrence, Mass.

C. NORRIS RABOLD
Director of Chemical Research and Development, The Erwin Cotton Mills Company, Cooleemee, N. C.

J. GILBERT MEARNS
Vice-President and General Manager, Hohokus Bleachery, Hohokus, N. J.

HILLARY ROBINETTE, JR.
Chemist, Amalgamated Chemical Company, Philadelphia.

FRANK L. BRADLEY
Chief Engineer, Forstmann Woolen Company, Passaic, N. J.

L. W. Craft, E. I. duPont de Nemours & Co., Inc., New York, is Secretary of the Committee.

—♦ ♦—

Southeastern Section to Meet April 23rd

THE next meeting of the Southeastern Section will be held on Saturday, April 23rd at the Ralston Hotel in Columbus. (The date of this meeting was erroneously stated as April 29th in the "Calendar" for March 21st).

Charles A. Seibert of E. I. duPont de Nemours & Co., Inc. will speak on "Fastness to Light and Washing of Dyed Cotton Fabrics." Mr. Seibert is chairman of the Washfastness Committee of the AATCC. A movie "Harnessing the Rainbow" will also be shown at this meeting.

W. B. Amos, Fairforest Company, Eagle & Phenix Division, Columbus, is program chairman for the meeting and is being assisted in the arrangements by Robert L. Horney, Ciba Company, Inc.

Research Highlights

WATER RESISTANCE OF TEXTILES

The procedure for using the rain tester is now an official AATCC Standard Testing Method, having been approved for such use by the Research Committee after a trial period as a tentative method.

PERSPIRATION TESTING

A simpler technique, capable of better reproducibility will shortly be presented for approval. The solutions presently in use are considered adequate.

RESISTANCE TO INSECT PESTS

After much discouragement with the difficulties of standardizing test conditions involving the use of insect pests this committee has completed the experimental phase of their investigations and expects to make recommendations in the near future.

NEW ACQUISITION FOR AATCC LAB.

Atlas Electric Devices Company has presented to the AATCC a new Launder-Ometer of the latest type with vari-speed drive and a pump for draining the water bath. It is also equipped for specialized experimental work. This is a useful addition to the Association's facilities at Lowell Textile Institute and will be used by the Association in its research program.

EMPLOYMENT REGISTER

This column is open for four insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Lowell Textile Institute, Lowell, Mass. It is understood that these will be open to inspection by prospective employers, who can obtain further information from the Secretary.

48-24

Education: Expects B.S. in textile chemistry, Clemson College, 1949.

Experience: Two years stockman and metal worker; five years U. S. Navy. Officer in various student organizations.

Age 30; married; industrial and college references; N. E. preferred, but will go elsewhere; interested in textile resin application research. 1-10, 2-7, 3-7, 4-8

49-4

Education: Ph.D., organic chemistry; member Phi Beta Kappa, Sigma Xi.

Experience: Supervision of synthesis, and measurement of properties, of detergents and textile auxiliaries.

Age 39; married, happily employed but nearing end of research project; position in northern U. S. desired. 3-7, 3-21, 4-4, 4-18

49-5

Education: Lowell Textile Institute.

Experience: Textile Chemist and Quality Control Supervisor; Pilot, U. S. Navy Airbranch.

Age 32; married; references; position as Chief Chemist or Quality Control Director desired. 3-7, 3-21, 4-4, 4-18

49-6

Education: Three years college chemistry.

Experience: Chemist and Supt. of Dyeing, 25 years practical experience on woolens, rayons, nylons, silk, etc.

Age 50; married; references; will work anywhere. 3-21, 4-4, 4-18, 5-2

49-7

Education: Clemson College; expecting B. S. in Textile Chemistry, June, 1949.

Experience: U. S. Army and three years as bookkeeper.

Age 26; unmarried but with one dependent; South preferred, but North acceptable. 3-21, 4-4, 4-18, 5-2

49-8

Education: R. I. School of Design, graduating in June, 1949.

Experience: One summer, research asst.; editor of college year book; war service.

Age 25; married; references. 4-4, 4-18, 5-2, 5-16

49-9

Education: Clemson College, Textile Chemistry & dyeing, graduating in June, 1949.

Age 22; unmarried, references. 4-4, 4-18, 5-2, 5-16

Annual Banquet Session—

OLNEY MEDAL PRESENTATION*

To Harold M. Chase, October 23, 1948

Harold M. Chase, The Man

By W. B. CARROLL, JR.

I SHOULD be worried about this speech, in that I invariably acquire acute congestion of the cerebellum when I stand up before an audience, but the subject on which I am to speak is so near and dear to my heart that I am endowed with more than the necessary courage to make these few remarks that follow.

I was rather amused to read the Associated Press release of the announcement of Mr. Chase's selection for the Olney Medal to this effect, and I quote, "Mr. Chase, the only Southerner to receive this award, was born in Massachusetts." We, of the South, are proud that he saw fit to come down and cast his lot with us, and has allowed himself to be so completely adopted by the South that he calls himself a reconstructed Yankee.

It is a privilege and a pleasure to review for you some of the achievements of Harold M. Chase as a man. A man who has made a most complete success of endearing himself to those around him by his modesty and unselfishness, in that he has always stood back and pushed the men under him to the fore to receive the credit for many ideas that have originated with himself.

A man who practices the Golden Rule in all his dealings with his superiors and subordinates alike. Many times I have gone to him for advice on how to discipline a man and invariably his suggestions could be boiled down into five words—"Put yourself in his place."

A man who can say, "Well done," or take one very firmly to the mat by the tone of his, "Good morning." I remember one morning when I was overseer of rawstock dyeing that a shift foreman came to me and said, "I certainly wish I had my section clean this morning, but things were so that I could not get to it on schedule." "You look like you really mean that," I said. "I really do," he replied, "because Mr. Chase came through this morning and after he had looked around for a few minutes, he turned to me and said, 'Good morning,' and with the tone of his voice he gave me more hell than you ever did with handles attached, and I tell you right now and here I am never going to leave myself open for a 'Good morning' like that again."

A man who is loved by children. I can vouch for this myself in that the times that Mr. Chase has honored us by being a guest in our home the immediate reaction of our children, ranging in age from 14 to 4, is, "Oh boy, Mr. Chase is coming."

A student and lover of nature. I can recall instances where his knowledge of nature has assisted him in his everyday duties. Once, in the selection of a combination of colors for a fabric line, Mr. Chase laid down a rule that I have always found to hold fast without exception, that if in the designing of fabrics one selects colors and hues that occur together in nature, these same combinations applied to fabrics, will always be pleasing to the human eye.

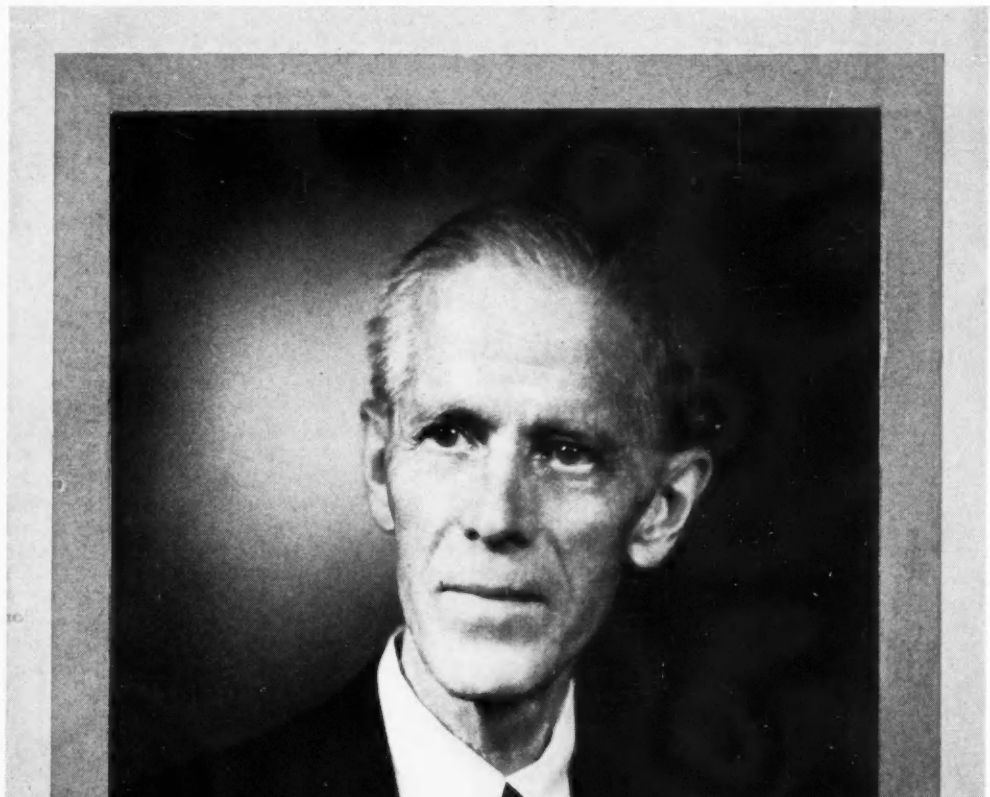
Another instance where his close study of nature served him was when he exhibited a magnolia bud before a group as "a magnificent example of nature's way of proofing materials against her own inroads." I know that many later developments of that group had their beginning from this demonstration on his part.

His fairness and consideration for his fellow man is unsurpassed wherever he comes in contact with people. A simple example of this trait was shown on a bird hunt with Jack Crist. A covey of quail had been flushed and the singles were being hunted, when an unpointed bird suddenly rose and Jack and Mr. Chase both fired at the same instant. The bird fell. "Which one of us do you think got that one, Chasie?" Jack asked. Mr. Chase replied, "Well Jack, when the dog retrieves it, it he's warm, he's yours. It he's cold, he's mine. That's how I knock 'em."

Perhaps one of Mr. Chase's most outstanding achievements is that of *developing men.* I have talked to numbers of men who have left Dan River to go to other plants and businesses, from Assistant Shift Overseers to Presidents, and they all agree that their association with Mr.

* Presented at Annual Banquet, Augusta National Convention, October 23, 1948.

The Olney Medal



HAROLD M. CHASE
Fifth Olney Medalist
1948

Chase played a major part in the shaping of their careers and afforded them much enjoyment in pleasant reflections. Under Mr. Chase's guidance, men who have stayed at Dan River, and those who have gone outside, have become men who eventually lead their field of endeavor. No one could be associated with Mr. Chase for any period of time without having the desire to follow the pattern set up by his sterling character and his never ending thirst for knowledge and self-improvement.

I end with this excerpt from Walter Locke,

"Were I so tall to reach the pole,
Or grasp the ocean with my span—
I must be measured by my soul;
The mind's the standard of the man."

* * *

Harold M. Chase, The Scientist

By P. J. WOOD

HAROLD MASON CHASE was born in Dracut, Mass. After attending the schools in his native town, he spent six years at the Massachusetts Institute of Technology, receiving the degree of S.B. in Chemical Engineering in 1894. After one year and summer school in post-graduate work he was awarded the S.B. degree in Chemistry. The chemical engineering course was admittedly one of the stiffest courses at M.I.T. and one of his friends declares that he always felt that he took this course more for the intellectual challenge that it offered than for any other appeal.

In extra-curricular activities, the same mental urge was evident. We learn that his thirst for knowledge led him to the fields and mountains to botanize and collect minerals, to know the fauna and flora at first hand.

Dr. Charles Greely Abbott, the distinguished secretary of the Smithsonian Institute, was one of his classmates who rivalled Chase in the race for academic honors and the competition between them was very keen.

In his post-graduate years, he worked particularly with Dr. Arthur A. Noyes, the eminent chemist who did so much to establish the Theory of Dissociation.

For most people, this would seem to constitute an ample education, but not so with our friend. In later years, we find him taking special courses in Petrographic Microscopy and Analytical Micro Chemistry during the years 1929 to 1934 in a further quest for knowledge, at a great expense of time and effort, involving laboratory work and study nights, after a long day's work in the mill, and by driving from Danville, Va., to Chapel Hill, N. C. at week ends. Again, in 1946 and 1947, he took extension courses in Radio and Electronics in Danville, Va.

In 1895, he received an invitation from a Mr. Hugh MacRae, also a graduate of M.I.T., class of 1885, to manage a small dyehouse in Wilmington, N. C. Although his education, up to this time, had been purely theoretical, he took the job, in spite of the fact that he had never seen the inside of a dyehouse.

Regarding this episode in the life of our friend, one of his classmates reports: "When I arrived in Wilmington a couple of months later, I found that Chase had not only competently taken charge of the dyeing and reduced costs, but had trained a second hand to handle the routine work, while he, Chase, was making studies of the cotton manufacturing process as a whole. Further, he was giving courses in applied spherical trigonometry with examples and demonstrations on the fine pool and billiard tables of the Cape Fear Club. Also select groups were taking post-graduate studies with his active assistance and co-operation on the Theory of Probabilities, illustrated by the Combinations and Permutations possible in a deck of cards."

The use of natural dyestuffs was still quite common at that time and the colors employed in the dyehouse run by Mr. Chase were indigo, which was ground in a small hand mill and vatted with zinc, bisulfite and lime, for the blue shades, logwood, cutch and fustic for blacks and browns. The brighter shades were obtained with some of the early direct colors and with basic colors dyed on sumac and tartar emetic.

Raw stock was dyed by poling the cotton in open tubs. Mr. MacRae and his chemist associate experimented with a method of dyeing picker laps which were dyed on beams, a system analogous with that used for dyeing warps at the present time.

They had plenty of trouble due to air spots and various mechanical difficulties but these were successfully corrected and they not only supplied the mills with dyed raw cotton of unusually good spinning quality but also developed a considerable business with neighboring mills.

They also developed a new method of mercerizing chain warps under tension which operated very successfully until the plant was destroyed by fire, as mentioned below.

Of this time, Mr. Chase reports that the overcoming of the many difficulties encountered during these years of his life proved to be of inestimable value in later years.

The dyeing enterprise was carried on in an old abandoned foundry which had been used for casting cannon during the war between the States, and was by no means ideal for the purpose. Mr. Chase was obliged to serve as mechanical and chemical engineer and assistant superintendent in the mill.

Mr. MacRae was interested in a great many things beside the making and dyeing of cotton goods, among them was the idea of recovering the turpentine from stumps and lumber waste from a cut-over long-leaf pine forest nearby. After the depression caused the closing of the cotton mill, following a disastrous fire, the turpentine propect was continued.

During the installation of a new gas plant in the city of Wilmington, Mr. Chase was called upon to operate the antiquated plant heretofore used. He ran this successfully until the new plant was completed, thus demonstrating his capacity of meeting unusual emergencies.

For ten years after the closing of the mill, our Medalist was connected with Mr. MacRae in various interesting projects, the development of a power project on the Pee Dee River being one of them; another was the colonization of a large tract of 70,000 acres by foreign colonists.

After these varied experiences, he finally returned to the textile industry in 1917, being employed by the Dan River Mills as chemist and assistant superintendent of dyeing.

His first assignment was the supervision of the operation of a small dyestuff plant for supplying the mills with dyestuff in short supply due to the first World War. He had had no previous experience in the manufacturing of dyestuffs, although he was familiar with the chemical reactions involved. He bravely tackled the job and succeeded soon in making an excellent brand of Primuline. This process was later sold to the Newport Chemical Works, and the product is still manufactured by one of the world's largest dyestuff manufacturers under the name of Primuline RD; RD signifying Riverside and Dan River. He also made Sulphur Yellow 2G, and an important intermediate dehydrothiotoluidine.

In 1919 Mr. Chase became Chief Chemist and Superintendent of Dyeing, and in the succeeding years Dan River led the industry in many modern developments. He designed what probably was and still may be, the largest raw stock dyehouse in the world, with a capacity of over 750,000 lbs. of cotton per week. He introduced the system of blowing hot air into the dyehouse to dispel the fog. This proved to be the first practical system of this kind, and has served as a model for modern types of dyehouse ventilation.

A tribute must be paid to the Medalist for one outstanding contribution he has made to many individuals and to the en-

tire industry. From the very earliest days of his association with Dan River Mills, he has made it a practice to employ the graduates of textile schools and train them for responsible positions in the various departments of the mills. Due to his natural ability as a teacher and the inspiration of his kindly leadership, many of these Chase graduates are occupying important positions, not only in Dan River Mills, but throughout the textile industry.

Under Mr. Chase's direction many revolutionary processes were invented, among which may be mentioned the long chain continuous indigo dyeing process, which he patented, the vat pigment continuous dyeing method patented by Glenn F. Womble of Dan River Research Department and the fiber bonded process patented by Dr. H. Y. Jennings of the same department. A paper on the latter process was presented by Mr. Chase at the AATCC Convention in Atlantic City in 1945. Other developments are the well known "Wrinkle Shed" creaseless finish, and water-repellent finishes.

Mr. Chase is a charter member of the AATCC and was the second chairman of the Southern, afterwards the Piedmont, Section. He is also a member of the American Chemical Society and the Virginia Academy of Science.

This is my brief. This is the story of a long and useful life. Our Medalist has earned the recognition of his fellows and richly has he merited the honor which is about to be conferred on him. Q. E. D.

* * *

At this point, Henry F. Herrmann, President of AATCC, presented the Olney Medal to Mr. Chase and read the following citation:

Citation

HAROLD MASON CHASE: You have given a lifetime of devotion to the science and practice of Textile Chemistry.

You have taken a keen interest in the art and technology of Textile Coloring and Finishing and its advancement.

By your ability and willingness to train others, particularly the younger generation, in this profession, and by inspiring them to the utmost of achievement, to the consequent benefit of the Industry, you have fulfilled the objects of our Association.

You have richly deserved the recognition of your fellow members and it therefore gives me as president of the AATCC the greatest satisfaction to present you with the Olney Medal which is awarded "For Achievement in Textile Chemistry."

Henry F. Herrmann, President, presenting Olney Medal to Harold M. Chase.

Mr. Chase: I'd be very much embarrassed if I didn't know I was in the hands of my friends. I can truly say to you that this most unexpected, and at the same time happy, surprise is one of the greatest moments of my life. This Medal will always be my most prized possession. I can only say to you that I thank you all from the bottom of my heart.

* * *

Address of the Medalist

By HAROLD M. CHASE

IN thinking over what I could say on this occasion it occurred to me that while much has been said about research and the dependence of the textile industry upon it for its material prosperity, something might be said on the subject of research in the individual mill for naturally the prosperity of the industry as a whole depends upon that of its separate units.

Some two hundred years ago the textile industry was going through what is known as the Industrial Revolution. This was the result of gradual transition from laborious hand work to mechanical mass production. There was no particular change in the product. Persian rugs, Gobelin tapestries, the silks and satins of that period are still unsurpassed in beauty.

For the last fifty years or so the industry has been going through another revolution. This one is due to increased knowledge of chemistry, particularly of organic chemistry and its applications to textiles, producing fabrics with entirely new qualities. Starting in a small way with the development of synthetic dyestuffs, it has gathered momentum like the proverbial snowball. It would take a truly Gargantuan mill laboratory to test and evaluate the thousands of dyestuffs, synthetic fibers, resins and organic chemicals which are available today.

This revolution is the direct result of chemical research which in turn has created a demand, in fact the absolute necessity, for specialized textile research. Textile research, like that of any other business or industry, falls naturally into two divisions, cooperative research for the benefit of the industry at large and mill research for the benefit of the individual mill.

A distinguished example of the former is our own Association, and I take this opportunity to pay tribute to that little group of men who organized it—to them and the many members who have given their time and energy to it—to the memory of one who was its staunch supporter and benefactor, Alfred Pettis Howes, and to the one who has been its guiding genius throughout its entire history, Dr. Louis A. Olney.

It is unnecessary for me to do more than to express my sincere admiration for the work of this Association and for its counterpart in England, the Society of Dyers and Colourists. Their collaboration on the *Colour Index*—the publication of researches of their members in the *Dye-*

stuff Reporter and the *Journal*—has raised the general level of performance in the industry immeasurably.

We also owe much to the various co-operative research institutes which are springing up—to the technical schools and colleges which are pouring out young men and women with textile and chemical training—to the Government laboratories and to the research laboratories of the dyestuff and chemical corporations. In short we have at hand a flood of information and new products which may well challenge the ability of any one man to keep up with it.

You are all perfectly familiar with the work of these organizations. The other division of textile research—that of the individual mill—has grown more slowly and is perhaps less clearly defined. I hope that what I have to say about it will be of interest to those younger members who are beginning their careers, and to those who are in managerial and executive positions and are considering the establishment of research laboratories.

To the man in the street research is a modern innovation. Those of us who have grown up with the industry know perfectly well that it has been with us a long time. The only innovation about it is that it is beginning to be recognized as a distinct and separate activity of the individual mill. Properly organized it is sure to pay dividends. Improperly organized it cannot withstand the impact of hard times. My ideas as to its organization may be unorthodox but are the result of considerable observation and experience.

If you will review the multitude of improvements in the application of dyestuffs and chemicals and the development of new processes, both mechanical and chemical, which have been made in the past, you will find that the majority of them have been made by "the man behind the gun" — by men and women well versed in the operations of the mill but engaged in the duties of production. You will also find that many of them are graduates of our technical schools and colleges or men of natural ability and ambition who are equally qualified.

The most logical way to start a mill research division is, therefore, to select from this fund of material those who have already demonstrated their ability. The basis of selection is highly important.

I was asked recently what I thought should be the characteristics of a research worker. My answer was that he should have an all-absorbing interest in mill problems, should have demonstrated his ability to handle them in a practical way and should be endowed with good common sense and an active mind. It goes without saying that the more scientific education and training he has the better, providing, however, that he is equipped with these characteristics.

College training is today the rule rather than the exception but it does not necessarily make a research worker. The above characteristics must go with it, for the sheepskin is merely a certificate that one has accumulated a lot of well known facts but by no means a guarantee that he will ever discover new ones.

I have seen men who were satisfied to follow the beaten path—to accept things as they are—to never change a formula or a process because consciously or unconsciously they were really more interested in something else. On the other hand, I have seen men to whom any mill process or problems was a challenge and who were never satisfied until they had improved it or solved it. As to common sense and practical ability there is no need to elaborate. We all know what they are.

The active mind is of immense importance in industrial research. One of the fascinating things about research is that the unexpected is always happening. While working on any problem some phenomenon which seems to be a nuisance is sure to crop up. The lazy mind discards it—the active mind sweeps immediately over all past experience and the chances are good that this particular phenomenon is the answer to some other problem. The more experience one has had the more likely it is that this will happen.

All children have active minds because everything is of absorbing interest and nothing escapes them. I read an anecdote recently which illustrates it admirably. A heavily loaded truck was jammed tight and fast under the steel beams of an underpass. The fire department truck could not budge it and it was decided to cut the beams. As the torch was about to be applied a small boy was heard to say, "I could get it out." The chief with the indulgent and superior air which goes with grown-ups said, "Well, son, how would you do it?" "Let the air out of the tires," was the answer.

Now the mill research division should be the answer to a pressing demand. The problems which when solved will prevent loss or increase profits should be perfectly well known and understood. If there are no problems there is no need for research. It is a fatal error to establish research and then look for something to do. The first activity of a research division should be to solve existing problems, many of which simply require a clear understanding of principles and concentration of effort on the part of research workers who are already perfectly familiar with them.

The logical nucleus with which to start is the chemical and dye laboratory, for it is in dyeing and finishing that the greatest number of problems are met. The problems of dyeing fabrics made from cotton, wool, silk, viscose, Bemberg, acetate, Aralac, nylon, Vinyon, Saran, glass and many more to come are simply staggering. Even on one fiber new properties and new methods of application of old and new dyestuffs are coming to light every day. It is true that the work of the dyestuff manufacturers and of our Association and of the S.D.C. has resulted in a mass of information with which every dyer and chemist should be familiar, but with varying conditions in every mill they should serve only as guides. No amount of reading and study alone can take the place of actual experiment and experience.

The same situation exists in preparation and finishing. Synthetic resins, detergents, wetting agents, softeners, water repellents and new chemicals and processes are multiplying so fast that research along these lines is not only profitable but absolutely necessary to meet competition.

To the research-minded dyer, finisher or laboratory worker, there are enough fascinating problems waiting for solution or improvement to satisfy the most ambitious. To quote one of my good friends, there is "so much to do and so little time to do it."

It is hardly necessary for me to cite these problems before this assembly. Mention of a few will illustrate the point. Take, for example, the application of vat dyestuffs to cotton and viscose alone. Twenty to thirty years ago we older men thought we knew all about them. Today we know that we only scratched the surface. The same is true of direct and azoic dyestuffs; and finally, the application of synthetic resins, fixing agents and chemical finishes entirely upsets everything. The best light-fast color may be ruined—the poorest improved. No one can be sure that his finished product is satisfactory without a thorough laboratory examination and even then the unexpected may happen in cutting, fabricating and usage. I could amuse you with many instances of the unexpected antics of the "gremlins" which haunt the dyer and finisher, but you have all probably made their acquaintance.

The preceding example is simplicity itself compared with the application of dyestuffs, resins and chemical processes to the various man-made fibers. It becomes necessary to go over the entire ground again in each case to determine which dyestuffs, if any, are suitable as to ease of application, level dyeing, fastness to washing, light, dry cleaning, etc. Complications increase in the case of blends. If only

one constituent of the blend is to be dyed a slight variation in the proportions of the blend will result in filling bars and streaks. A variation of the dye index of different lots of viscose or acetate will give the same trouble. It is necessary to sample each new lot from the manufacturer, send it to the laboratory and determine its dye index.

This is also true of different grades of cotton, and the laboratory is called upon to settle questions of shading and speckiness which may be due to improper dyeing or to the presence of immature or different types of fiber.

It is easy to see how the dye laboratory, originally a necessity for control of ordinary dyeing operations, gradually becomes transformed into a research laboratory. With increasing manufacturing complications it naturally grows to meet them. Its expansion is due to demand and it is, therefore, unquestionably profitable.

What is known as "trouble-shooting" has now become an absolute necessity in the modern mill. Many of the problems require not only the service of the trained chemist, but also a high degree of practical experience and mental activity.

In trouble-shooting as well as in all forms of research, the ability to draw deductions is of the greatest importance. For example, I have in mind a case where a garment was returned which was tender around the back neckline and for some little distance below it. No trace of oxycellulose was found. If the defect had been due to improper laundering the whole garment would have been affected. Apparently, no conventional method of analysis could solve the mystery. However, under ultraviolet light a distinct pattern of the underclothing was shown. Above the line of demarcation the fabric was tendered—below it there was no damage. The deduction was that sunlight combined with perspiration was responsible. As far as I know this is a new "gremlin". I have submitted it to our research committee.

To make deductions in textile research requires a thorough knowledge of all the conditions which exist in processing from the raw material through the finished fabric. For example, tiny spots occur on the finished fabric. The chemist unfamiliar with processing analyzes them and quickly finds them to be iron rust—beyond that he cannot go. The chemist familiar with processing first observes that the spots are on the filling and not on the warp, which carries the cause back to the looms. He then notices that they are practically always the same distance apart. This suggests contact of the steel rings on one bobbin with the yarn of another. Considerable moisture must have been present. His mind flashes back to the filling moistener or Hygrolit machine, and he has the answer. The obvious remedy is either to substitute bobbins with stainless steel rings at great expense and delay or to use a simple rust inhibitor in the moistening solution. Further loss is prevented. The stained goods are acid treated under his careful control and salvaged without loss.

This power of deduction is one of the greatest gifts a research worker can have. He is unlikely to have it unless he also has the other characteristics I have mentioned. In talking about it I always recall a story about Darwin, the great naturalist, which is a perfect illustration of the combination of all these characteristics.

Darwin lived in a small farming community and was greatly loved and respected by his neighbors. His word was gospel so when the clover crop failed they appealed to him for advice. "Get some cats," said Darwin. They did so and the clover crop came back. The mystified farmers asked him to tell them what cats had to do with clover. His explanation was as follows: Clover is cross fertilized by the ground bee. The ground bee makes its nest in the ground. Its greatest enemy is the field mouse and the greatest enemy of the field mouse is the cat.

I could go on indefinitely with examples of work for the research laboratory which without question are necessary to increase profits and to prevent loss. I have not mentioned analysis of competitive fabrics to determine identity and percentage of mixed synthetic fibers, their denier and staple length, the dyestuff and resins used. The microscopist and biological chemist pay dividends by work of this kind and by studies on mildewproofing and contamination of water supply. An epidemic of mildew or water contamination may cause the loss of thousands of dollars. The analysts, both inorganic and organic, add to dividends by duplication of mixtures which can be made in the plant with simple equipment, or by the invention of new ones. This activity alone will pay handsome profits.

I have tried to give you a very limited cross section of some of the activities of a mill research laboratory which I know from experience pay as they go. I have omitted many more equally profitable which I am sure will occur to you. I have not mentioned the library which should keep pace with the nature of the work being done; or micro-photography and projection which assist the manufacturing departments in locating weaving and spinning defects; or the testing laboratory, which is essential in trouble-shooting and in the evaluation of new developments.

We must not overlook the fact that with a staff such as I have tried to describe briefly many new ideas will be developed. It is practically impossible to conduct any kind of research without turning up something new and unexpected which furnishes material for further research. The profits from the activities I have mentioned may well be ploughed back into the field of what I would call deferred profits—that is to say, projects which when completed will be revolutionary and probably very profitable. Examples of this are the development of pigment dyeing and printing, the production of high strength yarns, of unwoven fabrics, of new synthetic resins, fixing agents, water repellents, finishing synthetics and their application, of twistless yarns and fabrics, shrinkless rayons, wrinkle resistant cottons, new methods of sizing and desizing. In short, these projects and many others, the development of which requires pilot plants, machine shops, special chemical, physical and electrical apparatus and equipment, have such great potential possibilities that they cannot be neglected by the progressive mills of the industry. The returns may well equal or exceed those of the parent mill, especially in times of depression.

What I have tried to emphasize is that establishment of the individual mill research division is strictly a business proposition and should be planned accordingly. It should be expanded to meet the demand for if properly staffed it will certainly prevent losses and increase profits. It may be expanded still further to create a demand for the special products of the individual mill, which in a highly competitive industry is an invaluable asset. Finally, it offers to the truly research-minded a fascinating occupation. They may work for a living but they also work for the fun of it.

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Philadelphia Section—

THE SCIENTIFIC APPROACH TO THE STUDY OF DYEING*

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DYEING was for many centuries an art handed down from master to apprentice and operated by rule of thumb combined with skill and long experience. It is only recently that attempts have been to treat dyeing as a science and as is usual with an old established trade, such attempts have met with opposition due to conservatism and plain misunderstanding. These difficulties are not encountered in industries which have developed from a scientific foundation such as the electrical or aeronautical industries for example. But if dyeing is not to stagnate in this present age, then a considerable infusion of scientific method into the trade is essential. The precise manner in which this can be most usefully achieved is however a matter of debate.

Generally speaking, the proponents of the scientific study of dyeing may be divided into two groups which for lack of a better term, I propose to call "technological" and "academic". The technological group of investigators are very largely concerned with using scientific methods and apparatus to define and catalog the behavior of a particular dyeing system with the object of placing it under more precise control so that the reproducibility of dyeing may be increased. Because of this aim, such investigators need to study dyeing under conditions which simulate as closely as possible those encountered in bulk practice. They are interested in results which are directly applicable to practice and not very greatly concerned with the fundamental reasons as to why the dyes behave in the way they do. To the academic group of workers on the other hand, the origins of dyeing behavior are the prime reason for studying the process and if results can be made less ambiguous in interpretation by deviating from practical dyeing conditions, as for example by dyeing from an infinitely large dyebath to obtain a constant concentration of dye in the dye liquor, then such conditions will be adopted. To take a very simple example of this different approach, it is common practice to start dyeing at a low temperature and then raise the temperature gradually, making additions of acid or electrolyte at intervals during the process. Many workers of the technological group have reported on the rate of absorption of dyes under such conditions and have attempted to use the results in the selection of dyes for particular purposes. The academic investigator however, feels that these results are largely meaningless as there are so many factors varying at the same time and he would prefer to study the process under selected conditions where only one factor at a time is varied, the others being maintained constant.

Naturally the question arises as to which approach is the more satisfactory. There is no definite answer to this question, as so much depends on the nature of the information required. For an urgent solution of a specific practical difficulty, the technological approach is better as it is far more likely to yield an answer in the limited time available. It is less likely however to give information on other problems which will arise later, than thorough understanding of the basic principles involved in dyeing such as may be obtained by the long distance type of academic investigation. On the other hand, the academic study of dyeing may often appear, especially in its early stages, to be quite divorced from reality and of no practical significance. The bridging of the gap between a knowledge of the fundamental principles of dyeing and their practical application is indeed one of the difficulties encountered today and one which can be solved only by increased educational facilities in the dyeing industry.

As you are probably aware, my own leanings are towards the academic school of thought as I feel that this is the more productive in the long run. This is of course a purely personal view which can be debated but I should like to take this opportunity of pointing out the advantages of the academic over the technological approach in one or two specific cases, and as the first of these I shall deal with the problem of classifying dyeing behavior.

From the technological side this problem has been approached in many ways depending on the particular characteristics of the dyeing process which appeared to be of great importance to the investigator. One of the outstanding features of any dyeing is that the reaction is not instantaneous but takes time and that the time of dyeing varies greatly from one dye to another. It seems obvious that this rate of dyeing represents a measurable characteristic of a dye which should aid in the selection of dyes suitable for specific dyeing processes, or for use in combination with one another, and accordingly measurements of dyeing rate have been made very extensively on almost every type of fiber. In general the measurements have been of two types, namely, those carried out under conditions simulating practical dyeing and those carried out under special conditions designed to emphasize a particular characteristic of the dye. Measurements of the latter type really belong to the academic study. Such, for instance, are the dyeing rate measurements of Boulton which are carried out with a dyebath which is never more than half exhausted. Under these conditions the rate of dyeing is really dependent on the rate of diffusion of dye inside the fiber as shown by the very close parallelism between Boulton's times of half dyeing of direct dyes on viscose rayon and the diffusion coefficients for the same dyes into viscose sheet as determined by Neale. The comparison is shown in Table I.

Confining attention then to the truly technological dyeing rate measurements under practical conditions, these normally give an indication of the time required by a particular dye to be absorbed by the fiber and also the final distribution of dye between fiber and bath or the exhaustion of the bath, under the particular conditions employed in the test. If the conditions are changed however, if the liquor

* Presented at meeting, Philadelphia Section, November 12, 1948.

TABLE I

Dye	Diffusion Coefficient in Cellophane Sheet $cm^2/min.$ (Neale)	Time of Half Dyeing of Viscose Rayon. Minutes (Boulton)
Icyl Orange R	180	0.11
Chlorazol Fast Orange G	156	0.07
Chrysophenine G	90	0.26
Diazo Brilliant Orange GR	50	0.22
Benzo Fast Bordeaux 6B	40	1.6
Durazol Red 2B	30	0.84
Chlorazol Fast Helio BK	27	1.27
Chlorazol Black SD	23	1.5
Chlorazol Fast Black BK	20	0.3
Chloramine Rose B	15	1.7
Chlorazol Violet R	10	0.5
Chlorazol Sky Blue FF	8	16
Benzo Purpurine 10B	5.2	28
Chlorazol Fast Blue 2BN	5.1	24
Benzo Purpurine 4B	4.6	8.9
Chlorantine Green BL	1.7	55
Chlorantine Blue 3GLL	1.3	125
Chlorazol Drab RH	1.2	115
Chlorazol Fast Orange AG	0.7	155

(The above table due to Neale, "J. Soc. Dyers Col.," 1936, *52*, 252, slightly extended to include later results by Boulton).

ratio is altered or the electrolyte concentration, the pH or the rate of circulation of the dye liquor, how will these changes affect the results? The technologist is able perhaps to give a qualitative indication, as for example, that increasing rate of liquor circulation should increase the rate of dyeing but leave the final exhaustion unchanged, but cannot apply any quantitative treatment to correct for such changes. The extension of data obtained on a laboratory scale to bulk working is thus extremely difficult and the results of doubtful value. The usual assumption made to overcome these difficulties, is that although the actual rates of dyeing of a range of dyes will be affected by dyeing conditions, the relative rates over a series of dyes will remain in the same order. In other words, the most rapid dyeing of a group of dyes, when tested in the laboratory, will also be the most rapid dyeing on the full scale plant. Another tacit assumption is that the dyeing rate of one dye will not be affected if a second dye is present. It is in the belief that these assumptions are valid, that rate of dyeing data is considered to be of practical value. There have been claims that mixtures of dyes of similar dyeing rates are more satisfactory in practice than mixtures of dyes with widely dissimilar rates, and also claims that the rate of dyeing may be used as an indication of the best technique of application. These claims may well be justified for it is probable that almost any sorting test would divide dyes into a number of groups such that members of any one group would be likely to show greater similarity in dyeing behavior than would be the case with dyes from separate groups. There is, however, very little detailed experimental evidence to either support or disprove the two assumptions mentioned earlier. We ourselves have studied the effect of liquor flow on the rate of dyeing of a very limited number of direct dyes on cotton and found the relative rates of the various dyes to be unchanged although the actual rates of dyeing increased greatly with increased rate of flow. On the question of admixture of dyes, however, there is definite evidence that in many cases one dye does affect the dyeing behavior of another and cases are known where a slow dyeing dye is absorbed first when it is mixed with a second dye of much greater dyeing speed.

A second characteristic of the dyeing process which has seemed important to many workers is the rate of migration of dye from dyed to undyed fibers, or the levelling power of the dye. It has been argued that dyes which level easily can be applied by almost any method without giving rise to difficulties whereas dyes with poor levelling properties must be applied much more carefully in order to get final uniformity of shade. This property forms the basis of a system of classifying direct dyes originally proposed by Whittaker and recently adopted by the Society of Dyers and Colourists. According to this classification direct dyes are divided into two groups according to whether they level more or less easily than a certain specified dye. The group which has poor levelling properties is further subdivided into two groups by a test for sensitivity to salt to determine whether or not it is possible to facilitate application by gradual additions of salt. The awkward squad of poor levelling and salt insensitive dyes may be applied, it is suggested, by the careful control of temperature, using a cool bath to retard the initial take-up of dye and then subsequently raising the temperature to improve levelling as much as possible.

Is this classification of value? Again no detailed tests of its validity in bulk scale working have been made to my knowledge, nor any tests of behavior in mixtures, but it seems very probable that the tests to divide the dyes into three broad groups, dyes within each group having somewhat similar properties, and to this extent the classification will almost certainly be of value in dye selection. For a quantitative explanation of dyeing behavior, the method is of no value and indeed was not designed for any such purpose but merely for qualitative comparison between dyes. Finally there is the question of the exhaustion of the dyebath and the effect of acidity and electrolyte concentration on that exhaustion. This also has received attention from the technological worker, although less attention has been given to the subject in the case of acid dyes on protein fibers than in the case of direct dyes on cellulose. This is understandable, as the exhaustion obtained in the former case is very high under normal dyeing conditions with nearly all dyes whereas with direct dyes the exhaustion varies widely from dye to dye and is very sensitive to the electrolyte content of the dyebath. Nevertheless even with direct dyes the subject of exhaustion seems to have received less attention from the technological investigator than it deserves. Boulton has measured the amount of salt needed with a range of direct dyes to produce an exhaustion of 50% on viscose rayon under a particular set of dyeing conditions while Neale has determined the weight of dye absorbed by cotton and viscose from a dyebath containing a fixed concentration of dye and salt. There is reasonable agreement between the two sets of results. Lemin, Peters and Vickerstaff have determined the exhaustion of direct dyes on cotton over a wide range of salt concentrations, all other conditions being arbitrarily fixed. Again the difficulty with all these results lies in their extension to other dyebath conditions and using the technological approach this cannot be done except by obtaining further experimental data. A final illustration will make this point clear and will pave the way for the exposition of the academic approach which follows. Suppose that is is desired to be able to predict the percentage exhaustion of a direct dyestuff on cotton at any liquor length, salt concentration and dye concentration, the temperature remaining fixed at 90°C., say. The technological method would be to determine, at a fixed dye concentration and liquor length, the effect of salt concentration on exhaustion the results being conveniently expressed as a graph. The experiments would then be repeated at another dye concentration until a series of graphs showing the effect of dye and salt concentrations was obtained. The experiments would then be repeated at different liquor lengths to give finally an enormous amount of data from which the required information could be derived. The academic approach

yields a much more concise method of obtaining the same result as will be indicated later.

From the foregoing it will be apparent that technological studies of the problem of classifying dyeing behavior have led to the development of a number of more or less empirical tests which are but vaguely interrelated. Furthermore these tests apply only to the particular set of conditions employed in dyeing and are not in general capable of quantitative extension to cover changed dyeing conditions. In other words the tests are very largely comparisons between dyes or between fibers and have little absolute significance. Let us now examine the alternative approach to the same problem in order to see whether it offers any advantages.

In the academic study of dyeing an attempt is made to discover what are the fundamental physical or chemical properties of the dye and the fiber which determine dyeing behavior. Since dyeing is a heterogeneous reaction it is reasonable to suppose that two steps are involved, namely the absorption of dye on the outer surfaces of the fibers, followed by diffusion of dye inside the fiber towards the center. This diffusion continues until the fiber is dyed uniformly throughout its cross section when the dyeing system reaches a state of equilibrium. On this view, the fundamental properties of the dyeing system are the equilibrium distribution of dye between fiber and dyebath and the speed of diffusion of dye inside the fiber. Consequently the academic investigator of dyeing attempts, in the first place, to measure and understand these two aspects of the process.

As regards the equilibrium state, the measurement of the dyestuff distribution is comparatively simple and the emphasis lies rather on the understanding of the dyeing mechanism involved. Without this understanding, the academic worker is in no better position than the technological, since he can only compile data under various dyeing conditions. If, however, a detailed theory of dyeing can be suggested then it is possible to derive equations relating quantitatively the amount of dye on the fiber to the other relevant dyebath conditions. Assuming that the experimental data confirms the validity of these equations then a great simplification and consideration of the data is immediately possible, together with the possibility of extension to other conditions not experimentally studied. The position will be clarified by discussing the particular case of direct dyes on cellulosic fibers although similar calculations have been successfully applied to acid dyes on wool.

TABLE II
Affinity of Chrysophenine for Cellophane at 40°C.

Salt Concentration in Solution	Affinity (Kg. cal. mole) Increasing Dye Concentration						Mean Affinity
0.5 gr. p liter	(6.5)	5.3	5.4	5.3	5.2	5.2	5.3
1.0 gr. p liter	5.0	5.2	5.2	5.3	5.3	5.2	5.2
2.0 gr. p liter	5.2	5.3	5.4	5.6	5.5	(6.0)	5.4
4.0 gr. p liter	5.1	5.0	5.2	5.4	5.3	5.3	5.2

To produce a quantitative treatment of cellulose dyeing we must postulate some mechanism of dyeing. That which is commonly accepted is that the dyestuff in the form of its sodium salt is completely dissociated in the dyebath into sodium and dye ions. The bath also contains sodium and chloride ions from the added common salt. Of the various ions in solution it is supposed that only the dye ions have a specific attraction or "affinity" for cellulose. Consequently some dye ions are taken up by the fiber, but this dyeing would very soon stop, if no other ions were absorbed because the dye ions carry from one to four negative charges and the fiber would quickly acquire a strong negative charge which would prevent any further absorption of anions. However sodium ions are attracted to the fiber, thus reducing the overall charge and permitting further dye to be taken up. The greater the concentration of sodium ions in the dyebath, the more easily is dye absorbed by the fiber. At equilibrium the fiber contains dye, sodium and some chloride ions and the relative concentrations of each ion can be calculated by applying the equations of Donnan membrane equilibrium. The details of this calculation can be found elsewhere. We suppose also that the dye within the fiber is completely dissociated into its ions. To treat such a system quantitatively we may write the equation

$$\frac{\left[\frac{Na_f}{V}\right]Z\left[\frac{D_f}{V}\right]}{\left[Na_s\right]Z\left[D_s\right]} = K \qquad (1)$$

which is a kind of mass action equation between the dye and sodium ions within the fiber and in the dyebath. In this equation Z is the valency of the dye ion so that dissociation of the dye molecule takes place according to the equation $Na_zD \leftrightarrows ZNa^+ - D^{z-}$. (Na_s) and (D_s) are the concentrations of sodium and dye ions in solution, while (Na_f) and (D_f) are the corresponding effective concentrations within the fiber. The concentrations in numerator and denominator of equation (1) must be the same units, namely weight per unit volume, but experimentally one can determine the concentration of dye or sodium ions on unit weight of fiber only. To convert these to volume concentrations they must be divided by V, which is the effective volume available to the ions per unit weight of fiber. K is the equilibrium constant.

In order to establish whether this equation has any real significance, it is merely necessary to determine the amount of dye absorbed at equilibrium by cotton or other cellulosic fiber over a wide range of dye and salt concentration and find whether K is actually constant. Detailed experiments of this type have been made by Hanson, Neale and Stringfellow, by Willis, Warwicker, Standing and Urquhart, and by Peters and Marshall, and in general confirm the validity of the equation. The results have been expressed more commonly in terms of the "affinity" —R T ln K (rather than K itself), this expression being equal to the change in chemical potential involved in the transfer of a dye molecule from solution to the fiber and expressed in Kg/cal/mole. As an illustration, Table II gives the affinity of Chrysophenine G for cellophane over an eight-fold range of salt concentrations and a range of dye concentrations varying between 100 and 300 fold, calculated from the data of Willis, et al.

Each figure in the table is derived from a separate experiment, the concentration of dye initially added to the dyebath increasing from left to right in each line of the table. It will be apparent that the results are remarkably consistent over this very wide range of dye and salt concentrations. Over the comparatively limited range encountered in practice the variation is less.

Having established in this way that the suggested equation (1) is valid in the dyeing of cellulose, then by reversing the procedure it will be seen what a remarkable degree of conciseness is now possible in describing the dyeing process. Given only one value, namely the affinity of —5.3 Kg. cal. mole at 40°C. it is possible to calculate what the exhaustion of Chrysophenine will be on cellophane at any salt concentration, at any dye concentration, and at any liquor length. The work of Peters and Marshall suggests fur-

ther that the behavior of direct dyes on other cellulosic fibers can be expressed in terms of the same affinity value provided that the volume term V is adjusted to suit each fiber. The values which have been suggested are 0.25 liter per Kg. for cotton, 0.45 for cellophane and viscose rayon and 0.65 for cuprammonium rayon. If, in addition the heat of dyeing is known, this one additional figure enables the calculations to be extended to any other temperature provided that the dyestuff does not undergo physical changes such as aggregation. Thus by means of an academic study of the dyeing process it has been found possible to compress the whole complex behavior of a direct dyestuff into two or three figures, a feat which is quite beyond the scope of a purely technological approach.

In addition it must be borne in mind that the thermodynamic quantities determined in this way are related to the chemical structures of the dye and the fiber and the manner in which they interact. The heat of dyeing may be regarded as the sum of the heats of formation of the various linkages between fiber and dye for example.

In the extensive studies of the effect of dye constitution on the substantivity of direct dyes for cellulose one of the chief obstacles has been the lack of a really satisfactory measure of substantivity. A number of empirical criteria have been suggested but all have proved unsatisfactory. Here however is the real solution of the problem for using these methods we can measure the "affinity" (or substantivity) of a dye for *cellulose* as distinct from its affinity for cotton or viscose rayon. It is unfortunate that the measure has come after the intense interest in substantivity has subsided but the methods are available for similar problems which will no doubt arise in the future.

Turning now to the second fundamental aspect of dyeing, namely the diffusion of dye inside the fiber, we find that the situation is far less satisfactory. Methods of measuring the diffusion coefficients of dyes in fibers are simple. Easiest of all is the method of dyeing from a dyebath of constant composition and determining the rate of absorption of dye during the early stages of dyeing. Under such conditions the process approximates to the diffusion of dye into an infinite plane slab and by plotting the dye absorption against the square root of the dyeing time a straight line is obtained, the slope of which is proportional to the square root of the diffusion coefficient. Unfortunately the diffusion coefficient so obtained is not a constant but varies with the concentration of dye, electrolyte and acid in the dyebath. The significance of these variations is being studied in detail by Crank, Standing, Neale and others but as yet no completely satisfactory explanation is forthcoming. If the diffusion of direct dyes into cellulose is followed over a range of electrolyte concentrations, the diffusion coefficient is found to increase at first and the decrease with increasing salt concentration. It appears almost certain that this effect arises from two conflicting factors. The first is electrical in character due to the fact that the dye ions and the cellulose are both negatively charged so that the approach of dye to the cellulose is impeded by the mutual repulsion. In complete absence of salt, especially with a tetravalent dye ion such as Chlorazol Sky Blue FF, this repulsion may be so great as to completely prevent dyeing, under which conditions the apparent diffusion coefficient becomes zero. On addition of salt the electrical repulsion is reduced by the screening effect of the inorganic ions and it becomes easier for the dye to approach the surface and the apparent diffusion coefficient increases. This effect soon reaches a maximum value when further additions of salt produce no effect. Conflicting with this effect is the second factor of affinity. It may be supposed that dye ions move towards the center of the fiber in a series of steps. A particular ion becomes attached to a cellulose molecule and remains fixed in that position until a collision with another molecule or thermal vibration gives it sufficient energy to break free when it can move on towards the center of the fiber. Thus the speed of diffusion will depend on the relative amount of time which the dye ion spends attached to the cellulose and in the free state. This is equivalent to the equilibrium distribution of dye between fiber and dyebath. It will be apparent that as more salt is added, the dye will spend less time in a free state capable of diffusion, and hence the apparent diffusion coefficient will decrease with increasing salt concentration. This effect combined with the electrical effect can produce the observed behavior of a maximum rate of diffusion at one particular salt concentration. However, this theory is not yet capable of giving a quantitative account of the changes in diffusion coefficient with dyeing conditions, so that here the academic approach is as yet no better than the technological, being merely confined to the accumulation of data under specified conditions. Further research of the academic type is required to elucidate this problem and it is to be hoped that it will ultimately be solved in as satisfactory a manner as that of the equilibrium state.

It has been suggested however that the differences in diffusion coefficients between dyes are so great that the effect of dyeing conditions is negligible in comparing dyes. For example, the rates of dyeing of direct dyes on viscose rayon as observed by Boulton cover the enormous range of more than 1000x from one of the most rapid dyeing dyes Diazo Brilliant Orange GR (C.I. 324) with a half dyeing time of 0.2 minutes to the slow dyeing Chlorantine Fast Scarlet with half dyeing time of 260 minutes. With such a vast range it seems reasonable to suppose that the diffusion of dyes in the fiber will be a very important factor in determining their dyeing behavior. Unfortunately the interpretation of these values is not unambiguous for there appears to be a definite relationship between the apparent diffusion coefficient within the fiber and the affinity of the dye for the fiber. Thus in a range of 15 acid dyes which we have studied on gelatine film, it was found that if the dyes were arranged in order of increasing diffusion coefficients this was almost exactly the order of decreasing affinity. Such a connection might have been anticipated from the earlier discussion, as the dyes of high affinity will spend a greater part of their time anchored to the fiber molecules and will thus have a lower apparent diffusion coefficient. Because of this interrelation between the two factors, the interpretation of the kinetic effects in dyeing is rather difficult.

In using fundamental data as a guide to practical dyeing one naturally seeks for the factor which has the greatest practical significance. Boulton, who was one of the pioneers in the application of scientific methods to dyeing, is of the view that the diffusion coefficient, as measured by rate of dyeing under special conditions, is the most important factor involved and selects dyes for use in mixtures on the basis of similar dyeing rates. However this may mean that the dyes have similar affinities in most cases. We ourselves have tended in the past to the view that affinity is the more important factor and have selected dyes on the grounds of similar affinity. Again by so doing we may be choosing, in most cases, dyes of similar dyeing rate. In an examination of binary dye combinations selected on the basis of dyeing rate determinations we found that about 70% of the combinations behaved in practice in the predicted manner. Selecting on the basis of affinity, we found about 80% of the combinations behaved as predicted, although the difference is probably not very significant. The truth of the matter is that to predict practical behavior we must take account of both factors at the same time. A method whereby this might be achieved has been suggested by Meggy. According to this theory the dyeing of a binary mixture of dyes may be regarded as a competition for the available surface of the fiber. We can imagine the surface to be shared between the two dyes and it can be shown that

the relative areas occupied are a function of the affinities of the dyes. The overall rate of dyeing of one dye will then be proportional to the surface area which it occupies multiplied by its apparent diffusion coefficient within the fiber. Thus for dye A

$$R_A = S_A \times D_A$$

where R_A is the overall rate of dyeing, S_A the area occupied by dye A and D_A its diffusion coefficient. A similar equation holds for the second dye B. If the two are to dye together then

$$S_A \times D_A = S_B \times D_B = R_A$$

or $\log S_A + \log D_A = \log S_B + \log D_B = K$

The log of the area is directly proportional to the affinity of the dye, so that

$$\text{Affinity} + \log D_A = K. \text{ - - -}$$

If we construct a diagram plotting affinity against log of diffusion coefficient then there will be a series of parallel straight lines covering the figure corresponding to the above equation for different values of K. If two dyes both lie on one of these lines then they should dye together even though they may have different affinities and different diffusion coefficients. We are now engaged in studying the possibilities of this treatment and have obtained very promising results in predicting the behavior of binary dye combinations with a rather restricted series of dyes up to the present time. Much further work on this topic and also on the interpretation of other practical dyeing characteristics in terms of the fundamental physical and chemical properties of the dyeing system remains to be done.

I have been asked to discuss the dyeing of nylon so I will take this subject as my second illustration of the advantages of the academic approach to the study of dyeing. When nylon was first introduced it was quickly found that it could be dyed fairly satisfactorily with the dispersed cellulose acetate type of dye. For many purposes however higher fastness was required and it seemed that the acid dyes might satisfy some of the needs. The acid dyes would certainly dye the fiber, which was in itself rather puzzling at first, but many difficulties were encountered in practical dyeing, particularly interference of one dye with another in mixtures and inability to produce heavy shades. The technological approach to this problem was to measure the saturation value of the fiber to the whole range of acid dyes and also the rate of dyeing under practical conditions and then to select those dyes having a high saturation value and for mixture work choose dyes of similar dyeing rate. The results were not too satisfactory especially with regard to the dyeing rate, for this particular dyeing system shows interference between dyes to a very marked extent and examples of slow dyeing dyes being absorbed before rapid dyeing dyes, when applied as mixtures, are very common. The technological study cannot proceed much beyond this point and cannot suggest reasons for this behavior or possible solutions of the dyeing difficulties.

The academic study of this problem begins by asking how the acid dyes combine with nylon fiber and the experimental work carried out by Peters was designed to answer this question. In the case of wool, the work of Elöd, Speakman and others has shown that the wool fiber contains ionized acid and basic groups and when placed into an acid wool dyebath containing hydrogen, sodium and dye ions, together with inorganic anions, first takes up hydrogen ions. To maintain electrical neutrality the inorganic anions such as chloride or sulfate are then absorbed and these are later displaced by the slower moving dye anions which may be regarded as forming a salt with the positively charged basic groups in the wool molecule. With simple level dyeing acid dyes, the maximum amount of dye which the fiber will take up corresponds closely to the number of basic groups in the fiber, namely 0.8 equivalents per kilogram approximately. In nylon however the fiber molecule consists mainly of aliphatic linear hydrocarbon chain segments linked by amide groups. There are a very few basic groups which occur at the ends of the polymer chains to the extent of about 0.04 equivalents per kilogram. At first it was thought that these basic groups were of no importance in dyeing. However Peters was able to show by dyeing nylon with acid dyes from dyebaths of varying pH, that the maximum amount of dye absorbed in the normal pH range of practical dyeing is about 0.04 equivalent per kilogram of fiber and furthermore that acetylation of the nylon which eliminates most of the basic end groups also reduces dye absorption considerably. Consequently it appears that acid dyeing proceeds in the same way as with wool, by salt formation with basic groups. The number of such groups in nylon is only one-twentieth of the number in wool. In terms of practical dyeing this means that wool will absorb about 30% of a commercial acid dye before it is saturated whereas nylon will absorb only 1.5%. In practice saturation of the fiber is never approached in wool dyeing but can easily be exceeded with nylon. This immediately explains the dyeing difficulties of inability to obtain heavy shades and of interaction between dyes. The latter phenomena is shown very clearly in the dyeings which I have with me. Here we have a series of dyeings on nylon with a mixture of a red dye of high affinity and a blue dye of low affinity. In each dyeing the proportion of red to blue dye added to the dyebath was constant, but the total amount of dye was increased from one dyeing to the next. In the pale shade where the total amount of dye is less than that required to saturate the fiber, both dyes are absorbed to produce the shade expected from such a dyebath. At the other extreme however where a very heavy shade has been applied, the amount of red dye is alone more than enough to saturate the fiber and because of its higher affinity it occupies the dye sites almost exclusively, so that the color of the dyeing is almost pure red, the blue dye remaining unabsorbed in the dyebath.

The academic approach to this problem thus gives a clear insight into the origin of the dyeing difficulties and immediately suggests three possible solutions of the problem. The fact that none of these solutions is practicable is irrelevant. The first solution arises from the observation that increased dye absorption can be obtained from a very strongly acid dyebath. Unfortunately the fiber is damaged under such conditions. The second solution is to select or synthesize a series of dyes all having the same affinity for nylon so that they will compete on equal terms for the dye sites and will thus yield the shade expected from the dyebath composition. Such dyes will not however yield heavy shades and also it proves very difficult to select dyes of exactly the same affinity although two or three combinations are known. The third solution is to synthesize a new "nylon" containing more basic groups. The dyeings in this second series show how the anomalous dyeing behavior already demonstrated slowly disappears as the number of basic groups is increased from 0.04 to 0.3 equivalents per kilogram of fiber. A value of about 0.1 equivalents per Kg would probably yield satisfactory dyeing properties for most purposes. It will be observed also that with such modified fibers it is quite easy to obtain very heavy navy blue and black shades.

I think that the two examples of research into dyeing, which I have discussed, provide considerable support for the view that fundamental research of the academic type is of greater value in the long run than the technological study. I am well aware that there are very many pertinent arguments which could be advanced in favor of the contrary conclusion, but I have deliberately presented by lecture in a biased manner in order to stimulate thought and discussion upon the subject. As with rate of dyeing and affinity, truth probably lies between, and the best results will be obtained by a nice combination of academic and technological methods.

N. Y. and R. I. Sections—

SHORT AGING PROCESSES

*For The Printing of Synthetics, Silk and Wool**

A. K. SAVILLE

E. I. du Pont de Nemours & Co., Inc.

THE printing of synthetic fibers, silk and wool has always presented a problem of correlating three equally important factors. Optimum color fastness and value are balanced against economy of operation. The influencing factor is the aging time. With acetate, acid and direct color prints, cottage steaming for one hour is required to obtain the best value and fastness. Shorter steaming periods in cottage or other types of steamers have been employed but a corresponding reduction occurs in dye fixation and yield. This paper discusses new developments in short aging processes which offer the fastness and color value of older cottage steaming methods produced more economically in a rapid ager or tower ager.

Nylon

Because nylon is comparatively new and has presented some difficulty in the printing field, it was the first material to claim our attention.

ACETATE DYES.—Dispersed acetate rayon colors, used extensively for dyeing nylon show good affinity for the fiber when printed without assistants from such thickeners as gum tragacanth, textile gum or British gum. The addition of small quantities of Cellosolve, urea, diethylene glycol or glycerine serves primarily to help disperse and partially solubilize the color, and results in improved levelness and smoothness of the prints. However, complete fixation of the color when printed in this manner can only be effected by cottage steaming the printed fabric for one hour at atmospheric or slightly elevated pressure.

For some time our aim has been to reduce the steaming time necessary for the fixation of acetate dyes on nylon and acetate rayon to the point where maximum color fastness and yield could be obtained in the rapid or tower agers. These agers are standard equipment in all printing establishments. A satisfactory method eliminating the expensive cottage steaming currently employed in favor of rapid aging would make the printing of these fibers possible in any plant.

Early studies of the printing of nylon disclosed that high concentrations of solvents could be tolerated by textile gum, gum tragacanth, Keltex or carboxymethyl cellulose. In the new process we have greatly increased the quantities of solvent-type assistants ordinarily used in these thickeners and find the color value, produced by a short aging of the print, to be equal or superior to that obtained with conventional printing paste formulations. The suitable solvents were also evaluated and a mixture of diethylene glycol and glycerine selected as the preferred combination for printing nylon and acetate rayon with acetate colors.

When printing pastes are prepared with a high concentration of solvent, the dyestuff is in a finely dispersed form. After printing, as the water on the print evaporates to leave only color, dry gum and the diethylene glycol-glycerine mixture, the concentration of effective solvent is increased. In this system the acetate colors are soluble. The gradual transition from a flat dull appearance as the print leaves the machine to the bright shade of the dissolved color when the print is dried, can be readily observed in the drying stage. Therefore, when the print enters the ager, the dye is present in such a form that it can be rapidly fixed when the dyeing temperature of the color is reached and the fiber is slightly swollen by the moist steam and solvent.

It might be expected that this quantity of solvent added to the paste would tend to cause facing on the print roller as well as flushing or feathering during the printing operation. But during a number of large scale plant trials of this process, no facing or flushing which could be attributed to the new formulation was experienced. Mark-off and flushing in the ager have also been significantly absent. Advantages of this method include not only a reduction in steaming time; but sublimation of the color does not occur; the goods are uniformly steamed throughout a run with the result that there are no variations in shade from end to end or side to center of the piece; the solvent combination does not cause tendering on acetate rayon since goods which have been excessively tendered by a prolonged cottage steaming have been satisfactorily run by this method. Fixation of color by a short aging is excellent; little soaping down in the wash boxes occurs; and the fastness properties and color value are at least equal to those from conventional methods.

The suggested formulation for printing standard colors on both acetate and nylon is given in Table I.

Keltex, gum tragacanth or a medium grade of carboxy-methyl cellulose can be substituted for the textile gum, however the greatest color value is obtained when carboxymethyl cellulose is used as an assistant.

ACID AND DIRECT DYES.—The process for printing acetate dyes on acetate rayon using a short aging procedure will be of some interest to the printing trade. However, due to the fastness limitations, printing of the acetate colors on nylon will probably not be extensively exploited. It is, therefore, necessary to look to other dye classes for colors with fastness properties more in line with the durability of nylon fibers.

Colors from the acid and direct classes include the fastness dyestuffs which can be currently applied to nylon. Acid and direct dyes have similar printing properties and may have good affinity for nylon, but their color value, rate of fixation and brilliance are considerably enhanced by the use of assistants. Those formerly recommended: urea, hydroxyacetic acid, a mixture of urea and hydroxyacetic acid, or other organic acids, are specific for

TABLE I

Printing Standard Colors on Acetate and Nylon

0.5-3.0 parts color
15.0 parts diethylene glycol
5.0 parts glycerine
19.5-17.0 parts water
60.0 parts Textile gum
Print, age five minutes.

* Presented at meetings, New York Section, January 28, 1949 and Rhode Island Section, February 25, 1949.

the individual dyes. If optimum results are to be obtained colors requiring different assistants should not be mixed. This restriction is particularly onerous in cases where emphasis on fastness to washing or light is required, and the best shading color is one from a different assistant class. Such combinations of colors rarely produce the predicted shade.

However, even if colors requiring the same assistant are used to produce a given shade, the mixture may not be compatible and the expected shade may not be obtained. For instance, a mixture of one blue and a yellow may give a blue instead of a green; another blue and yellow may result in a yellow; while a third combination will produce the expected green. A further difficulty in the conventional printing of nylon with acid or direct colors is the barré effect. Barré is caused by adjacent warp or filling threads exhibiting different affinities for the dyestuff. While colors of the acetate class generally minimize these differences and produce a smooth dyeing or print, those of the acid or direct classes accentuate barré and the finished goods show pronounced streaks through the colored areas. The affinity of acid or direct dyes for nylon is good, but only a few could previously be fixed in a short rapid aging process, and even those with exceptional affinity developed greater strength on cottage steaming. It will be realized that these printing deficiencies markedly retarded the use of nylon in the trade.

Experience gained from printing acetate dyes on nylon as well as acid and direct dyes on other fibers, led us to believe that faster and improved fixation could be obtained on nylon if the proper assistant mixture combining solvent power for the dye and swelling action on the fiber were obtainable. We have found Kromfax with thiourea to be the most efficient combination of dye solvent and swelling agent for printing acid or direct colors. The suggested formula employs 10 to 12% Kromfax, 6% thiourea, and 4% of an acid forming salt such as ammonium sulfate in a conventional rayon printing thickener. Naturally color value and printing properties vary considerably between the various thickeners, but the sharpest and smoothest prints are obtained by using a good grade of textile gum. After printing and drying, the goods are steamed for ten minutes in the tower or rapid ager at 218°-220°F., soaped and finished.

Many of the usual restrictions on color choice do not have to be observed and regard must be paid only to the saturation point of the color which, incidentally, is considerably increased by this technique. Dyes can be chosen for their fastness properties alone according to the particular purpose for which they are intended. Because of the increased rate of dyeing and saturation point accompanying the use of these solvents in nylon printing, no difficulties are to be expected with mixtures of formerly incompatible colors. Mixtures of yellows and blues give greens, mixtures of yellows, blues and reds give browns or grays. A further important advance in printing nylon with this formulation is the elimination of barré. Blotch prints are smooth; no differences in affinity of the various warp or filling yarns appear as alternate light and dark streaks in the finished pattern. It is therefore, possible to produce prints on nylon which are excellent in appearance and with fastness limited only by that of the available dyestuffs.

We realize that the Kromfax and thiourea recommended as assistants are expensive but the improved working properties of the colors and the greatly reduced operating cost will more than compensate for the increased cost of the printing paste. It should be emphasized that not all colors are equally suitable for use in this process but from the large number of available dyes, color selection for any particular shade, or fastness requirement can be made. In general, the fastness to washing presents no difficulty since, with few exceptions, all members of the acid, direct, and metallized classes are exceptionally wash fast. Typical dyes will show negligible loss in strength or shade change after five washings at 105°F. (AATCC Test No. 1), or after two washings at 160°F. (AATCC Test No. 3). This, we believe, will be satisfactory for uses for which the printed nylon fabric will be employed. The critical requirement is the fastness to light. Marked differences in light fastness are encountered on nylon fabrics containing various amounts of delusterant. Time does not permit a detailed discussion of the effect upon individual colors. It will only be possible to outline the relative light fastness of the various dye classes on nylon.

Metallized colors, as a class, exhibit the highest degree of light fastness; the yellows, oranges, and blues, being superior to the soluble dyes so far tested. These colors work well in combinations and under the proper conditions built up to heavy shades. No particular application difficulties should be encountered since they possess excellent solubility in the printing paste. From the experience of dyeing or printing the metallized colors on wool, it has been observed that no bright shades can be obtained. This is not especially disadvantageous because in styles where the maximum in light fastness is required, subdued tones are ordinarily employed. Second only to the metallized colors in light fastness and superior in brilliance are the acid anthraquinone colors. Dyestuffs of this group supply greens and blues complementary to the reds, and yellows predominant in the metallized classes and enable particularly attractive compound shades to be produced. Where light fastness is subordinate to brilliance large numbers of azo colors from the acid class can be used to produce prints of excellent wash fastness and brilliance but with only fair to moderate light fastness.

TABLE II

Printing Acid Colors on Nylon

0.5-5.0 parts	color
6.0 parts	thiourea
12.5-8.0 parts	water
12.0 parts	Kromfax
4.0 parts	Ammonium sulfate
65.0 parts	Textile gum
100.0 parts	

Print, age 10 minutes.

Table II is a summary of the recommended printing formulas for the acid colors on nylon. It should be borne in mind that acid, direct and premetallized acid colors can be used in combinations with the formulation.

Wool

ACID COLORS.—The success in developing a method for printing acetate and acid colors on nylon indicated that it might be possible to apply modifications of these processes to the printing of wool, silk and viscose-process rayon. Again the object was to replace the long steaming required for the fixation of these colors by a rapid aging.

In the printing of wool very little modification was found necessary. While in nylon printing a mixture of Kromfax and thiourea was found the best combination of printing assistants; for wool, Kromfax and urea are satisfactory. With a printing paste containing approximately 10% of Kromfax, 10% of urea and 4% ammonium sulfate to provide sufficient acidity to fix the color, acid and direct colors can be printed on either chlorinated or unchlorinated wool piece goods and fixed by a ten minute rapid aging. Fastness tests on a large number of representative acid colors printed by the new method and compared to other prints made by the conventional formulation, indicate that there is no significant difference in color fixation. Visual and spectrophotometric examination of the soap liquors from the aged and steamed prints reveal that those made by the new process bleed slightly less during soaping. It is probable that in printing wool from the solvent system, the increased speed of color fixation is again due to the

TABLE III
Printing of Wool

0.5-3.0	parts color
10.0	parts urea
13.5-11.0	parts water
4.0	parts Ammonium sulfate
12.0	parts Kromfax
60.0	parts Gum tragacanth
100.0	parts

Print, age 5 minutes.

slight swelling action of the solvents on the fiber and the excellent solubility of the colors in the printing paste.

Silk

ACID COLORS.—Similarities in the molecular structure and properties of wool and silk suggested that a corresponding acceleration in the rate of color fixation on silk could be accomplished by related techniques. However, silk is more easily swollen by solvents and many acid colors exhibit faster rates of fixation on silk than on wool, even under normal dyeing and printing procedures. For this reason, assistants milder in their action than those required for wool, should be satisfactory. We have found that Kromfax, used in wool printing, can be replaced by diethylene glycol. Using 20% diethylene glycol as the main assistant, adding 10% urea to help solubilize the color and 4% ammonium sulfate to assist in the color fixation, acid and direct color prints on silk can be fixed in a five minute aging. Basic colors, with or without tannic acid and acetic acid, can be applied in a similar manner if the ammonium sulfate is omitted from the formulation. No restriction is placed on the thickeners that may be used, but textile gum gives the sharpest print and gum tragacanth or Keltex may be used in patterns where the ultimate in sharpness of mark is not required.

Viscose Rayon

ACID COLORS.—Small yardages of viscose rayon fabrics are printed from time to time with selected acid and direct colors in imitation of silk styles. The affinity of acid and direct colors for viscose is poor; and in order to fix the colors and obtain maximum fastness to washing, perspiration and other wet destructive agencies, the printed fabric must be steamed in a cottage steamer for at least one hour. Assistants are always used to aid in color fixation. Of these urea is

TABLE IV
Printing of Silk

0.5-3.0	parts color
10.0	parts urea
20.0	parts diethylene glycol
7.5-5.0	parts water
2.0	parts ammonium sulfate
60.0	parts textile gum
100.0	parts

TABLE V
Printing of Viscose Rayon

0.5-3.0	parts color
12.0	parts urea
22.5-20.0	parts diethylene glycol
15.0	parts water
50.0	parts 3 per cent Keltex
100.0	parts

Print, age 5 minutes.

almost universally employed because it is unique in its ability to help solubilize and accelerate the fixation of all colors used in this type of printing. Since acid and direct colors can be fixed by a short aging when printed with solvent-type assistants on nylon, silk and wool, it is probable that similar techniques could be adapted to the printing of viscose rayon. Diethylene glycol in combination with small quantities of urea has been found the most satisfactory solvent combination for this type of work. While any conventional rayon printing thickeners can be used in the short aging formulation, Keltex gives the best color yield. The finished printing paste should contain 3% Keltex as a thickener, 15% diethylene glycol and 10% urea as printing assistants. Color fixation is effected by a five minute rapid aging in a moist rapid or tower ager. Color bleed during the rinsing and soaping of the prints is less than when a conventional cottage steaming formulation using 18-20% of urea is employed. It is recommended that some aftertreating agent be added to the last rinse to prevent bleed during drying. In general, fastness tests on cottage steamed prints and the solvent-printed, short-aged prints, do not show any significance in fastness to light, washing, perspiration or crocking, indicating that the colors are as well fixed on the fiber as is possible with a printing technique.

Summary

The processes for printing synthetics, silk and wool are functionally similar. In each case the choice of assistant and its concentration is such that a solution of the color is present either in the printing paste or is formed when the aqueous portion of the paste evaporates during drying. The color, in solution instead of in the pigment state as in conventional printing, is rapidly and completely fixed during a short aging. The advantages of this technique are many: sublimation of acetate colors will not occur, the saturation points of acid colors on nylon will be increased, the compatibility of the colors improved and the barré minimized. By using continuous aging instead of batch cottage steaming, the printing costs will be lowered. Labor costs and steaming time should be reduced and uneven steaming along the piece and between successive batches eliminated.

Research Highlights

THE GENERAL RESEARCH COMMITTEE recently heard reports indicating that a number of the working subcommittees are bringing their work to conclusions of interest to those who are concerned with textiles.

THE WASH FASTNESS COMMITTEE announces that a new test in the well-known and widely distributed Launder-Ometer will shortly be available. The new test prescribes a change in the accessories used in the instrument and one test will produce color changes comparable with those resulting from five average commercial launderings. Physical damage to the textile material may also be predicted. Confirmatory tests are planned in representative laboratories before the new method is distributed.

THE LIGHT FASTNESS COMMITTEE announces that the Bureau of Standards is now ready to distribute calibration papers to those desiring them. Their use provides a means of controlling Fade-Ometer exposures regardless of variations in electric current and other factors which have been responsible for unsatisfactory comparisons.

THE COMMITTEE ON FASTNESS TO PERSPIRATION has submitted a new test method and a new apparatus for conducting the test. Perspiration tests may be completed in six hours, with better agreement amongst themselves and more easily judged test pieces. The test will be official as soon as the apparatus is available to the trade which should be in a few months.

THE COMMITTEE ON INSECT PESTS has completed a thorough review of testing methods. The present standard A.A.T.C.C. test method was demonstrated to produce duplicate results in different laboratories, and a numerical system for expressing results has been announced. A technical report covering this work will shortly appear in the technical press.

THE COMMITTEE ON COLOR is proceeding to set up standard testing procedures for testing dyes in a spectrophotometer.

THIRTEEN A.A.T.C.C. TEST METHODS have been adopted as standard test methods by the American Standards Association. They will be so identified in the new A.A.T.C.C. "Technical Manual and Year Book" which goes to press shortly.

RECOGNIZING THAT STANDARD NOMENCLATURE AND METHODS OF CLASSIFICATION are as necessary as standard test methods in arriving at clear reports of tests, A.A.T.C.C. has set up a Committee on Nomenclature and Classification. The following are members of this new committee:

C. Z. Draves, Chairman; John N. Dalton, Earl Edgerton, Wm. A. Holst, Jules Labarthe, Alfred L. Peiker, Charles A. Seibert, Thomas R. Smith, A Frank Tesi, Harold H. Taylor, M. Antoinette Falcone, Laura E. Pratt and Mary P. Shelton.

Hudson-Mohawk Section—

THE FUNCTION OF A LABORATORY IN THE EVALUATION OF TEXTILE FINISHES*

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IN my remarks this evening, I am not going to tell you of anything new in the textile field, neither am I going to claim that the laboratory can give you all the answers. What I am going to do is to try to show where the laboratory fits in, what it has done, what it is doing, and what it can be expected to do in the future. As a chemist, I will naturally emphasize the chemical and related aspects, but it is an undisputed fact that it is almost impossible to separate the chemical from the physical in such evaluations.

Before proceeding further, let me give you what I consider a broad and adequate definition of "textile finish": "A CHEMICAL COMPOSITION WHICH WHEN APPLIED TO A TEXTILE MATERIAL BY SUITABLE MEANS PRODUCES CERTAIN DEFINITE QUALITIES OR IMPROVEMENTS IN SUCH TEXTILE MATERIAL OR FABRIC." This definition of course differentiates a chemical finish from an effect produced by mechanical means or by water or water-vapor alone (although in one sense, water may be regarded as a chemical and a very useful one too). Many times, mechanical means are used together with chemical finishes to mutual advantage, and I do not intend to belittle the mechanical end of finishing, which supplements the chemical aspect much as the chemist and finisher supplement each other.

Having defined a chemical finish, let us consider just how it acts on the fiber or fabric to produce the desired results. There are, of course, two classifications possible: (1) Actual chemical reaction with the fiber, and (2) One or more of several physical effects.

Chemical Effects

In the first classification, there are a few well known examples, but by and large, this classification is very much in the minority. Of the examples which can be mentioned are the well-known water-repellent finishes, "Zelan" and "Norane", in which the finishing agent is said to react with cellulose of the cotton or rayon fabric under certain conditions. More recently, a fire-retardant finish which reacts with cellulose to form "cellulose phosphate" has been developed. In the case of wool, it is obvious that the chlorine used in the many variations of the shrinkage-control process actually combines with the amino-groups of the wool fiber. In the mothproofing processes developed by Dr. Harris, there are several instances of chemical reaction involving the cystine linkage. I suppose that mercerization (assuming caustic soda to be a finishing chemical) can also be put in this class, since it produces a modification of the cellulose structure.

Physical Effects

The large majority of chemical finishes produce their results by means of physical or rather physico-chemical effects. Let us consider what some of these may be. Lubrication is certainly an important factor in producing softness, but there are two kinds of lubrication, external and internal. The former concerns itself with the relationship of the fiber, yarn or fabric to other surfaces and is of prime importance in the mechanical handling of such materials. The latter concerns itself with the lubrication of fiber against fiber. Internal lubrication may be considered a form of plasticization enabling the fibers and their component parts to flex readily, thus contributing to softness. The chemist at present has no way of testing or measuring such effect. Swelling is a factor to be reckoned with in connection with many types of finishing compounds and doubtless contributes to the feeling of weight or body in a fabric. Another factor allied to swelling is the attraction of water by hygroscopic agents used in connection with finishes. Such substances as glycerine, glycols, sorbitol, and certain salts, such as acetates, lactates, etc., are often used for such effect. Water is, of course, one of the best plasticizers, and as such, acts as a softener when retained in textiles by means of such agents.

A physical effect which is the opposite of lubrication is sometimes desirable in certain finishes. This can best be described as "frictional" and is exemplified by the so-called colloidal silica dispersions. Such agents give anti-slip properties and usually cause a fabric to feel somewhat harsh. Related to this type of effect is the property of adhesion, characteristic of many resin finishes. In this case, the finish not only causes the fibers or filaments of the yarn to stick together but also cements the filling threads to the warp threads. Such an effect tends to stiffen a fabric, and mechanical treatment is often necessary to break the fabric down to obtain a desirable hand, and the adhesion or bond must be strong enough to withstand such treatment.

There are many other ways in which finishing agents produce their results, among them being film formation as in the case of water-repellents, and adsorption or substantivity as in cationic finishes. Generally speaking, the mechanism of the way in which finishes act on textiles is very complicated and is actually little understood from a scientific viewpoint.

Classification of Finishes

There are two ways of classifying finishes from a functional standpoint. The first is in relation to the hand or feel of the fabric, and the second, as to the specific property imparted for a particular purpose, such as water-repellency.

The hand of a fabric may be described by many different terms, many of which are overlapping, and all of them rather broad. For example, the term "soft" may have quite a range of meanings, such as: "raggy", "mellow", "lofty", "smooth", "plastic", etc., representing different degrees or types of softness. There is, however, no scientific nomenclature of technical classification of this property. For purposes of simplification, I suggest the following six terms to cover the classification of "hand".

Softness	Smoothness
Body	Firmness
Stiffness	Resiliency

* Presented at meeting, Hudson-Mohawk Section, January 21, 1949.

Many finishes may impart two or more of these characters to a fabric and there are, of course, several degrees in each property, which can be recognized by careful comparisons to be described later. For example, a fabric may have softness, smoothness and body all in one, or it may have softness with one of these other properties or with none of these. Smoothness, of course, is a surface phenomena, and is sometimes described as "top finish". In the case of stiffness and resiliency, the latter term includes the character of the first plus the ability to spring back to its original form.

Durability or Permanency

Today we hear a great deal about "permanent" finishes, and this applies to all types and classes. The term "permanent" is somewhat misleading, and it seems preferable to use "durable" in such cases. When this term is employed, the question of *"how durable"* arises immediately. This question is important, and the laboartory plays a major part in answering this question. Unfortunately, however, there exists today very little in the way of standards for such work. By standards, I mean accepted or official standards by which everybody can agree as to how durable a certain finish is. To illustrate this point, we had the occasion to test the durability of a new water-repellent finish to laundering and used two different methods. The first consisted of 0.1% of a standard soap at 100°F. for 10 minutes; the second, 0.5% of the same soap at 120°F. for 30 minutes. According to the first test, the finish was durable and by the second test it was not. The number of washings in each test was three and the method of testing was the A.A.T.C.C. Spray Test. What can we conclude from these test? I don't know. It is evident that standards for durability are necessary if this term is to mean anything along these lines by the various A.A.T.C.C. technical committees.

FACTORS IN DURABILITY TESTS.—Usually, when durability of a finish is mentioned, it is understood that laundering or dry-cleaning or both are concerned. But what kind of laundering or what kind of dry-cleaning? The factors of time, temperature and concentration of soap were mentioned in the example previously referred to, and these are primary factors in any test involving laundering. Among other factors is the question of the degree of motion during laundering; for example, the gentle up-and-down motion of home rinsing cannot be compared to the vigorous action of a power laundry wheel. Also, the question of the detergent to be used may be significant. If a soap, what type, what pH, etc.; if a synthetic detergent, which one? In the case of dry-cleaning, the factors are somewhat simpler, and the question resolves itself chiefly into the nature of the solvent. It is known that petroleum solvents such as Stoddard Solvent or Varsol are less powerful than carbon tetrachloride, trichloroethylene and other chlorinated solvents, and this must be taken into account when durability to dry-cleaning is considered.

However, it should be kept in mind that the petroleum solvents are more widely used since they are cheaper, and where only one solvent is specified, it is usually "Varsol".

Generally speaking, specifications for durability should be related to the use for which the textile in question is intended. For a garment which is only infrequently laundered or dry-cleaned, perhaps 3 to 5 of each processing would be a sufficient index of durability.

However, for sheets or similar articles which are frequently laundered, 50 washings would give a more practical valuation. Also, in the latter case, higher concentrations of detergent and higher temperatures would be indicated for a suitable test procedure. In the case of many acetate fabrics, durability of a finish to dry cleaning is usually considered more important than to laundering. Again, I would like to emphasize at the risk of being repetitious, that when the term "durable" is used in connection with a finish, always ask "how durable" and "to what"?. There is much work to be done by the laboratories of the textile industry before the question of durability can be well defined and standardized to the satisfaction of all concerned.

General Methods of Evaluating Textile Finishes

Instead of trying to cover the entire field in discussing what I choose to call general methods of evaluation, I am going to take the group of agents called "softeners", which is one of the more important classifications in this field, and use this to illustrate the methods in question. It should be kept in mind that many of the tests to be described are applicable to other groups and types of finishes. My point in considering softeners in rather great detail is to outline systematically the tests which the laboratory applies in evaluating them completely. Besides the evaluation of the softening qualities *per se*, such factors as resistance to oxidation, rancidity and yellowing, effect on the tensile strength of the fabric and effect on the dyestuffs, and even the question of possible dermatitic effects on the human skin which may come in contact with such finished fabrics, must be considered.

CLASSIFICATION OF SOFTENERS.—Softeners may be conveniently divided into three groups: viz. Anionic, Cationic and Nonionic, which of course, is a strictly chemical classification. To clarify this matter, I will again go to definitions. The term "ionic" indicates that the substance in question forms electro-positive and electro-negative particles in water solutions. An anionic finish is one in which the active part of the molecule is the anion or "negatively charged" portion. Illustrative of such finishes are the ordinary sulfated oil finishes, such as sulfated castor oil, etc., in which the fatty part with its combined SO_3 forms the anion, and the sodium, potassium or ammonium hydroxide used for neutralization forms the positively charged part of the molecule. Other sulfated oils, including teaseed, soya, mustard seed, peanut, etc., of various degrees of sulfation and still widely used as finishes, are included. The fatty alcohol sulfates are also anionic in character. Another anionic group often employed in finishing is comprised of saponified or partially saponified fatty acids. In the case of the cationic finishes which have increased in importance in recent years, the active part of the compound is in the cation or positively charged portion. The negatively charged part is usually chloride or an organic acid, such as acetic or formic. In most cationic compounds, nitrogen is present in the cation. As manufactured, such compounds are usually quite alkaline and not very soluble in water, and the addition of acid or negative ion serves both to neutralize and solubilize. Another group of cationic finishes contain quaternary compounds which can be made from tertiary nitrogen compounds. The nitrogen in this case becomes pentavalent, and the resulting compounds have many of the advantages of the usual cationic finishes without their disadvantages. The cationic group of softeners have certain distinctive properties which I will describe very briefly. As compared with the anionic softeners and the non-ionic group to be described later, the cationics have the property of substantivity or tendency to exhaust on the fiber similar to that of a dye. Accordingly, they are used in rather low concentrations as compared with other softeners, usually in the range of 1 to 2 parts per 1000. They have disadvantages in many cases, such as changing the shade of a dye and effecting adversely the fastness of many dyestuffs to light. Also their compatibility with other agents is notoriously poor, and it is always recommended that preliminary tests be made before mixing a cationic finish with any other finish. Recent improvements in the form of modified cationics

has changed this picture to some extent.

The other class of softeners is the "nonionic" type, and this theoretically includes any substance used as a finish not included in the anionic and cationic groups. Admittedly, such substances as urea, glycerine, glycols and sugars are nonionic, but more specifically, the more modern nonionic softeners are synthetic fatty esters which are soluble or dispersible in water. Their solubility is brought about by reacting a fatty acid with compounds having two or more hydroxy groups, or with ethylene oxide. As a result of such reaction, a fatty compound of comparatively high molecular weight is formed, which is not ionized in water. Accordingly, such compounds are usually more stable than anionics and cationics to external conditions and are highly compatible with many substances. There are many advantages in finishes of this type, and I am of the opinion that they will grow in importance in the future.

DEGREE OR TYPE OF SOFTNESS —When a softener is used, the first question is to what extent does it soften the fabric in question, and how does it compare with other softeners. Actually there are both quantitative and qualitative considerations involved, and we can express these as degree of softness and type of softness respectively. Before going farther, it must be admitted that there are no scientific methods or measurements for these factors, and it would appear difficult to develop methods for such measurements. Accordingly, we have to depend on the sense of "feel", and the chemist has to bow to the finisher for final evaluation of a softener. However, in the laboratory, it is possible to make series of finishing tests for comparative purposes which do give some information to the chemist. Such tests have to be run under closely controlled conditions; to be of any value, and even then are subject to a considerable "personal" factor. In our laboratory the fabric selected for the particular finishing trials is cut into pieces of suitable size (8-9" x 10-12"), and worked in solutions of the finishing agents at the desired concentration for about 1 minute. The temperature of the solutions is controlled in a constant temperature bath within one or two degrees for each series of tests. The temperatures used in different series vary in accordance with the type of finish and fabric concerned. After removal of the fabric from the solution, it is allowed to drain for about 1 minute and then put through squeeze rolls set at a predetermined pressure. It is then put on a pin frame and dried in an oven (forced draft) for 3 minutes at a controlled temperature (usually 220-230°F.). After conditioning overnight, the series of fabrics is ready to be evaluated by the "touch" system, and this is where the personal factor comes in. At this stage the reactions and judgment of 3 experienced persons are utilized, and each rates the fabrics according to degree of softness, surface-slip or smoothness, body or weight or other pertinent factors. In this way softeners having similar characteristics can be grouped together, and rather slight differences noted in the group as a whole. This method, while far from scientific, has been found very useful in developing new finishes to obtain certain desirable characteristics.

Along true scientific lines, there have been a few methods proposed which require special apparatus, but which appear to be of only limited value. Among these is the "Drapemeter", which appears to have some value for measuring the stiffness or resiliency factor in finishes. A recent article, by Skinkle and Moreau in the AMERICAN DYESTUFF REPORTER of October 6, 1947, describes a proposed improvement in this instrument and gives an excellent summary of its field of usefulness. Other methods such as a determination of the coefficient of friction (for smoothness or slip) and measurement of the swelling of the fibers (for body or weight characteristics) appear entirely too theoretical for our consideration.

RANCIDITY.—Having considered one of the factors about finishes (softeners) of which we know little or nothing from a strictly scientific viewpoint, let us turn to some other factors about which we have at least some definite technical data. The factor of rancidity or stability to oxidative influence is of great practical importance in the study of finishes. The factor of yellowing is many times tied in with rancidity. Of the chemical nature of rancidity and its associated phenomena, there is considerable data. Briefly, many fatty compounds used in finishes have some degree of unsaturation, or what the chemist terms "double bonds", which is measurable by the iodine value. At such double bonds in the structure of the fatty compound, there is a tendency to take up oxygen chemically and form unstable by-products which decompose and give the characteristic odors of rancidity. To combat such development in chemical finishes when applied to fabrics, it has been necessary to use so-called anti-oxidants in these compounds. Such substances, used in relatively small amounts (1% or under), delay or minimize the chain of oxidative reactions described above. There are several hundred available chemicals claimed to have this property. However, from practical experimental results on textile materials, there are only a few which are entirely satisfactory for incorporation into textile finishes. In our experience, Thymol and related compounds are among the most satisfactory for soluble fatty derivatives. Some of the alkyl substituted hydroquinones and alkyl gallic acid esters have also proved of value for this use.

As a practical means of evaluating the oxidative resistance (resistance to rancidity) of finishes when applied to fabrics, and comparing the efficiency of several anti-oxidants, the Arkansas Company laboratories have developed a simple method which has been proven to correlate well with actual results. I give it in some detail. Pieces of white cotton cloth free from all sizing and finishing agents —(ordinary cheese cloth has been found to be ideal for this test)—are dipped in a solution of the finish or finishes in question under controlled conditions—concentration predetermined—time and temperature set for any one series. After immersion, the samples are allowed to drain freely but not squeezed on touched with the hands. After drying overnight under atmospheric conditions in a place protected from fumes and other contaminants, the samples are placed in clean, covered 8 ounce jars and put in a constant temperature oven at 140°F. (60°C.). At the end of every 24 hour period, the jars with the treated samples are removed, allowed to cool for about an hour to room temperature, and then the odor noted. This is continued for 4 to 5 days, or 96 to 120 hours, and each observation is jotted down at the time. Here we are dealing with the sense of smell, which is a very delicate and elusive measurement. However, it is highly quantitative, and if observations are written down immediately, good correlation is unusually obtained. The type of odor involved is typical of rancidity, and may be described as musty and sharp. To illustrate, I have with me some jars containing cloth treated with a sulfated oil finish having no added anti-oxidant. You will note the odor becomes more intense up to and including the 96 hour sample, and is about the same or falls off a little in the 120 hr. samples. Then, in the next series of samples, we have parallel tests made with the same oil to which an anti-oxidant was added. In this series there will be noted little if any odor of an objectionable type, although the anti-oxidant used in this case has a slight characteristic odor of its own. Now, as to the way in which we grade these odors and interpret the results. I should mention that controls are usually run with each series, consisting of two samples of the same fabric, one untreated, the other with only the anti-oxidant in the amount used

in the finishing compound. Any sample which after the 96 hr. exposure has an odor no stronger or different in character from the two controls is called "negative", this of course is the highest rating. A slight off-odor not definitely rancid is designated as "trace", while an odor suggesting the threshold of rancidity is noted as "slight". A definite odor of rancidity in the samples is graded by intensity as "one plus", "two plus" and "three plus". Many finishes of the sulfated oil type, if unprotected by anti-oxidants, will show a "plus" odor within 48 hours and "three plus" at 96 hours; whereas, if properly protected with a suitable agent, no more than a trace, or at the most a "slight" odor value, will be noted at the end of 96 hours. In our specifications for finishes, "slight" at the end of 96 hours is passable in some instances, while for other purposes, no more than "trace" is allowed. An observation at 120 hours is usually included as a check on the 96 hour test, and in most cases is somewhat less intense. It has been estimated that a period of 96 hours (4 days) at 140°F. usually represents a normal storage time of 3 to 6 months, depending on conditions of storage.

YELLOWING.—In the test described above, any tendency toward yellowing the fabric may also be observed at the same time as the odor observations. As a definite check on this factor, reflectionmeter readings are taken on the samples after the 120 hour period and compared with the reading on the untreated control sample which was subjected to the heat test at the same time. I do not have sufficient data at the present time to draw any definite conclusions as to the value of these readings, but this angle is being followed up in connection with further studies on rancidity. As a more severe test for yellowing, the method commonly used in the chlorine-retention test, in which the fabric is subjected to a temperature of 400°F. for 30 seconds, has been found applicable. In our laboratory, this test is carried out by means of an electric iron and a stainless steel plate (approx. 3" x 3½"), in which a Weston dial thermometer is inserted. The electric iron is placed on the plate and adjusted until the thermometer in the plate reads 400 F, plus or minus 2 degrees, steadily for 10 minutes. Then, the sample of fabric treated with the finish in question is inserted between the iron and plate for 30 seconds, and the yellowing effect noted and compared with that of other finishes on the same fabric. In all cases, the results should be compared with a sample of the unfinished fabric subjected to the same test as a control. We have noted that the yellowing produced by this test tends to fade slightly overnight, so a series of finishes is rechecked the following morning. For white goods to pass this test successfully, the yellow patch produced on the fabric should be hardly perceptible to the eye. The reflection-meter also may be used here to obtain quantitative values.

EFFECT OF FINISH ON TENSILE STRENGTH.—The question of whether or not a finish has any deleterious effect on the strength of the fabric to which it is applied is always pertinent. This phase of the subject, since it lies strictly in the realm of physical testing, will be passed over lightly. Generally speaking, a chemist first thinks of pH in relation to this factor, knowing that extremes of acidity or alkalinity in finishing compounds are definitely undesirable. We can say that a finish having pH between 5.5 and 8.5 (1% solution) is unlikely to produce any loss in tensile strength. On cellulosic fabrics, a finish with pH under 4 should be questioned and checked. Also it should be kept in mind that some finishes may develop acidity on ageing or during storage, and thus cause tendering. For such cases, an ageing test similar to that employed for rancidity is used, and the fabric is tested for tensile strength before and after the test.

EFFECT ON DYESTUFFS.—It is well known that certain types of finishes, particularly the cationics, have a definite tendency to affect the shade of many dyestuffs on the fabric. Studies in this matter have shown that these cationic finishes vary greatly in this effect when applied to a fabric dyed with a certain dye, and this effect may be graded as "slight" "moderate" and "marked". To a certain extent therefore, it is possible to select a finish which will have a minimum effect on the dye or combination of dyes in question. Also available at present are the so-called modified cationic finishes, which are more fool-proof in this respect, but which in many cases do not give the same type of finish as the regular type of cationic. An adverse effect in light-fastness of the dyes is also a characteristic of many cationic finishes, making it necessary to check all such finishes on dyed fabrics in the Fade-Ometer.

EFFECT OF FINISHES ON HUMAN SKIN.—Since finished fabrics come in contact with the human epidermis in the course of their wear, it is necessary to determine whether or not the finishes used have any harmful action on the skin. These effects are generally known as dermatitis, and may consist of anything from a slight irritation up to and including a marked inflammation of the epidermis. Fortunately there are not many chemicals used in finishes that have such effects, but there have been cases, particularly in the field of resin finishes, where dermatitis has developed on some individuals from contact with such finishes on fabrics. It has therefore been the practice of the Arkansas Company's laboratory to have this factor checked on any new finish which is developed. The method used is the so-called "patch" test carried out on an adequate number of human subjects. These subjects, as far as possible, are selected to represent a cross-section of the human race, with people of various age groups, and of all types of complexions as represented by color of hair and eyes. For a minimum test twenty-five subjects are used, and for a complete study one to two hundred are desirable.

As to details of the test, small discs are cut from the finished fabrics, wet with distilled water, placed on the inside of the upper arm or sometimes the forearm, and immediately covered with an Elasto-patch. This holds the fabric disc in place, and is waterproof and air-impermeable. At the end of three days, the patches are removed and the skin examined for indications of irritation. This examination is repeated every day for a week, and if no irritation is observed during this period, the reaction is called "negative" and the finish in question is passed as satisfactory. If some irritation or discoloration of the skin is observed, the reaction is called "positive", and if this happens in more than one or two individuals out of one hundred, the finish in question is not considered as suitable for commercial use. Where only one or two indiviaduals out of one hundred react positively, allergy is suspected and further checks are made. This test has beesn found definitely advantageous for the protection of our customers in this important phase of evaluating finishing agents.

Conclusion

While much of the foregoing discussion of general methods of evaluation of textile finishes has been directed toward softeners, it may be seen that most of these are applicable to all types. Accordingly, before any finishing compound can be considered for actual use on a customer's goods, it must be given a thorough going-over in the laboratory. The methods which are available for such work are limited, as I have tried to indicate in my discussion, and considerable improvement in laboratory techniques and methods would make the laboratory more useful in this field. Better correlation of the data which we can now obtain is also a necessary step in the right direction. As a chemist, I am necessarily an optimist, and I therefore look forward to considerable progress in this field in the years immediately ahead of us.

TRADE NOTES • NEW PRODUCTS

• Butterworth "Bullet" Padders

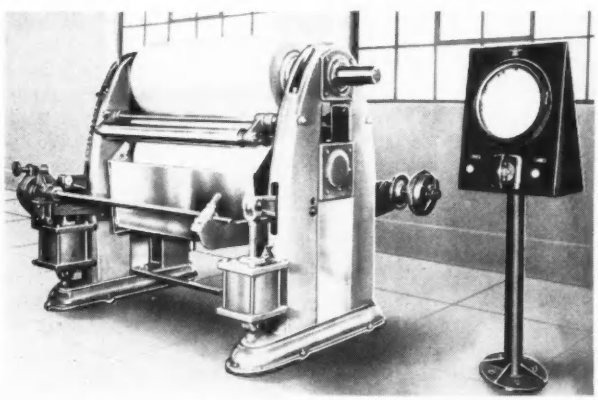
H. W. Butterworth & Sons Company, Philadelphia, Pa., has announced a newly designed line of padders known as the Butterworth "Bullet" Padders. These new 2-roll and 3-roll padders are reported to be more flexible, more interchangeable, and more basic than any padders now in use.

The new machines have a streamlined, bullet-shaped frame. It is stated that they are trim in appearance, compact in design and are extremely functional in operation. For example, it is now said to be possible to convert a 4-ton Butterworth "Bullet" Padder into a 15-ton padder without tearing out an entire frame or without loss of operational time. No more separate pads are required for each operation. With the Butterworth "Bullet" 2 and 3-roll padders, rolls in any diameter from 12 to 20 inches can be used. The new machines are also equipped to operate at any desired pressure from zero to 15 tons.

Interchangeability of rolls depending on the type of operation desired is one of the outstanding features of these new padders. In making a conversion, only rolls have to be changed, basic parts of the "Bullet" Padders remain the same.

Among a few of the features to be found on the new machines are: simplified controls; pressure ranges from 0 to 15 tons; heavy spherical roller bearings of the adapter type which hold rolls in fixed position; efficient, easy to reach lubrication system.

The 2-roll "Bullet" Padder and the 3-roll "Bullet" Padder are adaptable for light or heavy duty operation. The multiplicity of operations now possible with these new Butterworth machines is claimed to be a major step in finishing plant economy.



2 Roll Butterworth "Bullet" Padder (Heavy Duty) Front View.

• Edwal Appointment

Appointment of George L. Wheeler, manufacturers' agent at 12 S. Twelfth St., Philadelphia, Pa., as representative of The Edwal Laboratories, Inc., was announced recently by Dr. Walter Cuthmann, head of Edwal.

Mr. Wheeler will represent Edwal to customers in the territory which includes: Delaware, Pennsylvania, Maryland, West Virginia, the eastern half of Tennessee, North Carolina, South Carolina, Georgia and Alabama.

This move will permit service to all customers in connection with Edwal's line of bulk fine organic chemicals and special products for the pharmaceutical, photo and chemical processing industries.

• du Pont Rayon Appointment

The Du Pont Company recently announced the appointment of Dr. G. Preston Hoff as manager of the technical division of the Rayon Department. At the same time, Dr. Winfield W. Heckert, director of acetate rayon research, was named assistant manager of the division, succeeding Dr. Hoff, who has been acting manager since December 31.

• Durable Water-Repellent For Woolen Fabrics

A new and improved durable water repellent, Durable Norane W, for use on all-wool and wool blend fabrics, has been developed by the Warwick Chemical Division of the Sun Chemical Corporation, according to Al Leitstein, General Manager of the Featured Fabric Finishes Division of the firm.

Mr. Leitstein pointed out that, from the standpoint of the manufacturer, the process offers other benefits in addition to durable water-repellency. "It can be applied, so as to add body to a fabric or if desired, to add slickness to a hard fabric," he said, "and it can also be applied with practically no effect on the 'hand' or the appearance of the fabric."

Durable Norane W, according to Mr. Leitstein, also makes fabrics resistant to non-oily spots and stains, and adds crease and wear resistance. It is stated that efficient application can be made by any modern finishing plant or sponger.

The Warwick Chemical Division of the Sun Chemical Corporation also makes Impregnole renewable water repellent and Durable Norane water repellent. All Impregnole, Durable Norane and Durable Norane W processed fabrics are tested and approved for water repellency in the firm's laboratories under its Laboratory Certification plan.

• Burlington Foundation Grant

The Burlington Foundation, a trust set up by Burlington Mills Corporation, has made a donation of $25,000 to the North Carolina State College School of Textiles to be used for the remodeling of former classroom space into what will be one of the most modern textile library facilities in the nation.

Announcement of the donation was made by Dean Malcolm Campbell at the annual meeting of the North Carolina Textile Foundation.

Work of remodeling the classrooms into the library will be begun this fall upon completion of the two wings now being added to the Textile Building.

• To Receive SCI Medal

Foster Dee Snell, president of Foster D. Snell, Inc., New York firm of consulting chemists and engineers, has been named by unanimous vote of the council of the Society of Chemical Industry, London, to receive the Society's Gold Medal for 1949, according to an announcement made recently by the Society.

The Medal of the Society of Chemical Industry is awarded bi-annually by the Society's council to a person "who has attained eminence in applied chemistry". The medal was first awarded in 1896 and has since been awarded to only one American, Prof. Ira Remsen of Johns Hopkins University in 1904. The Society is a world wide organization with headquarters in London, and with sections in the United States, Canada and Australia.

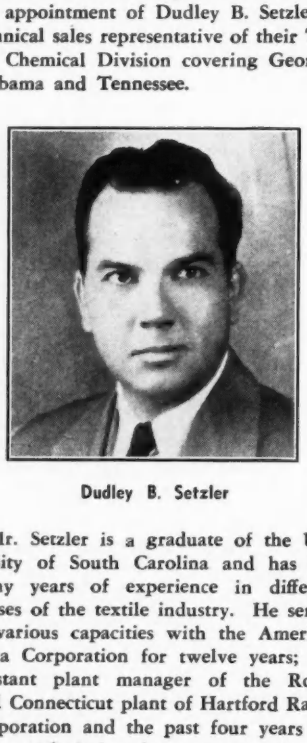
Dr. Snell will receive the medal at the Society's meeting at Manchester, England, July 13, 1949, when he will deliver an address on a phase of surface activity.

His special field of personal interest is surface active phenomena, which embraces the action of soaps, detergents, wetting agents and similar products.

Dr. Snell has been engaged in applying science to the problems of industry as a consulting chemist in New York and Brooklyn for nearly thirty years. He now heads the consulting firm bearing his name which comprises nearly a hundred persons. He was for many years Honorary Secretary of the American Section of the Society of Chemical Industry and has been its Chairman.

• Joins Dexter Chemical

Dexter Chemical Corporation announces the appointment of Dudley B. Setzler as technical sales representative of their Textile Chemical Division covering Georgia, Alabama and Tennessee.



Dudley B. Setzler

Mr. Setzler is a graduate of the University of South Carolina and has had many years of experience in different phases of the textile industry. He served in various capacities with the American Enka Corporation for twelve years; was assistant plant manager of the Rocky Hill Connecticut plant of Hartford Rayon Corporation and the past four years has been technical sales representative in Georgia and Alabama for Quaker Chemical Company. Mr. Setzler makes his home in Rome, Georgia.

• Versene Fe-3

Frederick C. Bersworth, President of Bersworth Chemical Company of Framingham, Massachusetts, announced recently that Bersworth chemists had developed a new sequestering agent called Versene Fe-3. This is said to be particularly effective in sequestering the trivalent iron that often exists as a chemical contaminant in solutions. The sequestering power of Versene Fe-3 for calcium and magnesium at a high pH is almost as great as the sequestering power of regular Versene.

Trivalent iron in water and other aqueous solutions has caused trouble in the preparation of soaps, fats, oils, emulsions, sanitizing agents, drugs, food products, textiles and metal processing. Therefore Versene Fe-3 should prove of interest to manufacturing and experimental chemists. It is now being produced in increasing quantities.

• Plans Made by Textile Institute for Closer Liaison

For some years the question of closer liaison between the Textile Institute whose headquarters are in Great Britain, and its members in the United States has been discussed whenever Council members of the Institute have been visiting America. These discussions have progressed to such an extent that when John Boulton, F.T.I. returned from America in April, 1948 he was able to make specific recommendations to the Council of the Institute for the formation of a Liaison Committee for the purpose of maintaining closer collaboration between the Institute and textile technologists in all fields working in the United States. This recommendation was cordially welcomed by the Council, who invited R. J. Kerr-Muir, a member of the Institute in New York, to convene a representative panel of members of the Textile Institute to consider this matter further.

The Panel which has been formed consists of the following:—

Dr. J. H. Dillon, Director of Research, Textile Research Institute and The Textile Foundation, Princeton, N. J.

K. R. Fox, F.T.I., President, Lowell Textile Institute, Lowell, Mass.

W. J. Hamburger, F.T.I., Director, Fabric Research Laboratories, Inc., Boston, Mass.

G. H. Hotte, F.T.I., Technical Director, A. M. Tenney Associates, Inc., New York, N. Y.

Professor E. R. Schwarz, F.T.I., Professor of Textile Technology in charge Textile Division, Massachusetts Institute of Technology, Cambridge, Mass.

Dr. Milton Harris, F.T.I., President, Harris Research Laboratories, Washington, D. C.

Dr. E. I. Valko, Director of Research, E. F. Drew & Co., Inc., Boonton, N. J. with R. J. Kerr-Muir, President, Lustre Fibres Inc., New York, as Convener and Chairman.

The Panel is intended to provide general liaison between the Textile Institute and technologists in the United States. In particular, it is available for advising members who might wish to apply for the Fellowship or Associateship of the Textile Institute (F.T.I. and A.T.I.). Fellowship and Associateship are recognized professional qualifications granted under the Royal Charter and are comparable to university degrees in the sphere to which they relate. Diplomas of Fellowship and Associateship are granted by the Textile Institute to those members who, upon application, bring satisfactory proof of fulfilling the conditions laid down by the regulations. Those interested in becoming Fellows, Associates or ordinary members are invited to contact the Panel through its chairman or any of the members.

It is hoped that through this Panel suitable exchange of opinions on textile education may be facilitated, with the general object of maintaining a high standard of requirements for such education. This might later be brought about by suitable exchange of British and American teaching staff and certainly by visits. A recent exchange of this nature has already been effected with most beneficial results between Professors Merrill and Morton of the Lowell Textile Institute and the College of Technology, Manchester, England.

American members of the Institute are being invited to inform the Panel of visits they are planning to make to the British Isles. The Institute headquarters is also asking for similar notice from British members visiting the United States. By this means it will be possible for the Panel and the Institute to be prepared to give any assistance the visitors may require.

There are at present some 131 members of the Textile Institute in the United States, of whom 17 are Fellows and 5 Associates.

• Golden Anniversary, LTI Alumni

The 50th Anniversary of the Alumni Association of Lowell Textile Institute will be celebrated this year with meetings in Boston and Lowell on May 13th and 14th, respectively.

On Friday, May 13th, there will be a banquet and entertainment in the Georgian Room of the Hotel Statler, and on Saturday, the 14th, it is expected that the largest gathering of Lowell Textile Alumni in the history of the Association will take place at the Institute buildings in Lowell, Massachusetts.

This will be a momentous occasion for Lowell Alumni as the cornerstone of the new quarter million dollar Alumni Library will be laid with appropriate ceremonies at that time. At the same time, the two new student dormitories will be formally dedicated in the presence of visiting dignitaries.

Tours of the Institute and dormitories will enable the alumni to observe at first hand the many changes and additions which have been made during the past year. A business meeting will be conducted in the morning and luncheon will be served in the new cafeteria located in Smith Hall. In the afternoon, the alumni will have an opportunity to see the current baseball team in action against

American International College.

Plans for this Golden Jubilee Reunion were formed by a committee headed by Roger C. Griffin, Jr., '43.

• Arnold, Hoffman Promotions

W. Chester Cobb has been elected Vice President in Charge of Sales of Manufactured Products of Arnold, Hoffman & Co., Inc., manufacturing chemists of Providence, Rhode Island. At the same time, Leonard G. Tubbs was appointed Assistant General Sales Manager.

Both promotions were announced by the Board of Directors as an effort to correlate the management of manufactured product sales and to increase Ahco's customer service in the diversification of manufacturing.

Mr. Cobb previously had been Southern Sales Manager since his separation from the Service in 1945. He served with the 339th Infantry as a Captain, receiving the Bronze Star and Silver Star medals for gallantry in action in Italy. He joined Arnold, Hoffman & Co., Inc., as a salesman in 1934 immediately after graduation from Clemson. Prior to the war, he was manager of the Charlotte, N. C. office.

Mr. Tubbs, who has been Northern Sales Manager since 1945, joined Arnold, Hoffman in 1939 as Manager of the New York Office. Previous to this, he had been Director of Purchases for the United States Finishing Company and also the National Dyeing and Printing Company.

• Annual Dinner, DCAT Section

Over 2200 leaders in the drug, chemical, cosmetic and related industries from all parts of the country heard Ferdinand Eberstadt, Chairman of the Committee on the National Security Organization of the Hoover Commission call for the formulation of a clear and sound National Security Policy at the 23rd Annual Dinner of the Drug, Chemical and Allied Trades Section of the New York Board of Trade, Thursday, March 10th, at The Waldorf-Astoria.

Robert B. Magnus (Vice President of Magnus, Mabee & Reynard, Inc.), Chairman of the DCAT presided.

Tribute was paid to the memory of the late Ralph E. Dorland, Former Chairman of the DCAT and former President of the New York Board of Trade, by E. T. T. Williams (Pres., The Lambert Co.), a member of the DCAT Advisory Council.

Lloyd I. Volckening (Pres., The Ivers Lee Co.), was in charge of dinner arrangements. Officers of the leading national associations related to the drug, chemical and cosmetic industry were seated on the dais.

The DCAT is composed of 700 firms, comprising sixteen divisions of the drug, chemical, cosmetic and related fields.

• New General Aniline Plant

General Aniline & Film Corporation opened a new pilot plant at Grasselli, New Jersey, on March 21st, 1949. The new plant is the first to be erected in this country for the utilization of acetylene at high pressures and temperatures.

A section of the new plant is given over to the development of improved processes for the manufacture of dyestuffs, textile auxiliaries and other General Aniline products.

"The versatility and usefulness of acetylene as a raw material are well known to chemists," according to Dr. C. R. Wagner, General Aniline Vice President—Operations, "but acetylene is also violently reactive and until the recent development of safety techniques by General Aniline, its potential could not be realized."

Products of high pressure acetylene reactions are expected to replace others now used in the pharmaceutical and general organic chemical fields as intermediates, plasticizers, coatings and adhesives.

• Sun Chemical Appointment

Ernest Nathan, President of Warwick Chemical Company, Division of Sun Chemical Corporation, announces the appointment of Walter E. Scheer as General Manager of their newly created Organic Chemicals Department, with headquarters at the main office of the company, 10th Street & 44th Avenue, Long Island City, New York.

Walter E. Scheer

Mr. Scheer has been a chemical consultant for the past several years and President of Scheer Chemical Company, Inc. Before that time he was associated with Hardesty Chemical Company, Inc., and its affiliate, Amecco Chemicals, Inc., where he was Vice President in Charge of Sales.

The Organic Chemicals Department is a new group in the Warwick organization which will concentrate on the production of industrial organic chemicals for all industries and on the development of household, industrial and other non-textile uses for synthetic detergents and other surface-active agents now widely sold in the textile field by the Warwick Chemical Division. New production facilities for the Organic Chemicals Department are being installed at the Warwick Chemical Division plant at Wood River Junction, R. I., and large scale commercial production of several new products is expected to begin in the very near future.

• Textile Institute Conference

In Dublin, Eire, next May, will be held the Textile Institute's Annual Conference, at which visitors from countries overseas from Britain are again expected. Last year, visitors from Holland, France, Norway, Switzerland, America and India attended the Institute's Conference at Buxton, England. The 1949 Conference, which will run from Tuesday, May 24th, to Friday, May 27th, will take for its theme "The Industrial Application of New Knowledge." Papers have been promised by leading British technologists, and John Boulton, F.T.I., who visited American textilemen last year while discussing the formation of an American Section of the Textile Institue, will present a general introductory paper to the Conference.

• Polyco 350

The American Polymer Corporation of Peabody, Mass., has recently completed installation of new high-pressure polymerization units which make possible large volume production of a synthetic latex of interest to the paper, leather and textile industries. Known as Polyco 350, this compound is a stable dispersion of a flexible high styrene copolymer resin. It is said to be ideal as a back sizing for pile fabrics.

Polyco 350 is stabilized during manufacture to withstand most of the extremes of handling and machining operations. Viscosity of the product is said to be controlled to provide greatest possible versatility. The dispersion is readily dilutable with water to reduce the working solids and viscosity. It is sufficiently fluid for saturation of porous articles, yet has ample working viscosity so that it requires little or no additional thickening for such uses as paper or textile coating, or as pigment binder.

Complete information is available on request. (Data Sheet P-11.)

• 2-Chloro-5-Nitrobenzotrifluoride

A new fluorine-containing hydrocarbon is in limited pilot plant production at the Hooker Electrochemical Company, Niagara Falls, New York. The product,

2-chloro-5-nitrobenzotrifluoride, is said to be of particular interest in the preparation of dyestuffs and intermediates. The compound is a straw colored, thin, oily liquid with a specific gravity at 25°C. of 1.5520. Its freezing point is 16.8°C, boiling point is 230°C, and its flash point is 135°C. Technical data sheet No. 369, describing the product, is available.

• Standard Soiled Cloth

Foster D. Snell, Inc. announce the availability of "Standard PSC Soiled Cotton" fabric prepared by a group at Pennsylvania State College under the supervision of Professor Pauline Beery Mack. With this fabric samples stored in the open air have shown no significant change after 10 years of storage.

After soiling, every piece is lightly washed to remove loosely adherent soil and read with the Hunter Reflectometer. It must agree with a reflectance of 27% within a tolerance of ±2%. Every tenth swatch is washed in an 8-step washing cycle with neutral soap and soda ash. To be acceptable it must give a soil removal efficiency in terms of brightness regained of 50±2.5% after five consecutive washes. The swatches are 5 x 12 inches, conforming to a standard of the National Bureau of Standards as to desirable size, to permit four fold-overs for reading in the reflectometer. When prepared, the swatches are given consecutive numbers. The unit package for sale consists of 9 consecutively numbered swatches, the tenth numbered swatch of that series having been used for standardization. The initial deliveries of this material will be made by April 1st. The price is $4.50 for a unit package with a schedule of discounts allowed on purchases of multiple packages of the soiled fabric.

Complete detail can be obtained by writing to Foster D. Snell, Inc., 29 West 15th Street, New York 11, N. Y.

• Awarded Honor Scroll

Donald B. Keyes, vice president in charge of planning and development of the Heyden Chemical Corporation, New York, New York, has been awarded the first Honor Scroll of the New York Chapter of The American Institute of Chemists, according to an announcement by Dr. Martin Meyer, chairman of the Chapter, and chairman of the Department of Chemistry of Brooklyn College. The citation to Dr. Keyes reads: "For his services and devotion to young chemists. His influence and guidance have brought happiness and distinction to those who have had the good fortune to be closely associated with him."

The Honor Scroll will be presented to Dr. Keyes at a dinner meeting of the New York Chapter of The American Institute of Chemists, to be held May 18, 1949, at the Downtown Athletic Club, New York.

• Publication Manager, LTI Alumni Bulletin

The Alumni Association of Lowell Textile Institute has announced the naming of James H. Kennedy, III, Class of 1948, as Publication Manager of their *Alumni Bulletin*. Mr. Kennedy attended Georgia School of Technology and Philadelphia Textile Institute in addition to his work at Lowell Textile. He had served as Editor and also as Business Manager of the undergraduate newspaper, *The Text*. He is at present studying under Prof. Edward R. Schwarz at the Massachusetts Institute of Technology Graduate School. The new Publication Manager holds membership in the American Management Association, Phi Psi Fraternity, and Tau Epsilon Sigma, textile honor society.

The *Bulletin*, official organ of the Alumni Association, is received by over 1900 alumni three times a year. The Bulletin Committee of the Association consists of Dr. Harold W. Stiegler '18, Prof. A. Edwin Wells '20, and J. Milton Washburn, '21.

• Elected Fellows of Textile Institute

Recently elected Fellows of the Textile Institute were John Hoye, and Julius B. Goldberg.

Mr. Hoye is the head of the Hoye Textile Corporation of New York. A contributor to the Encyclopedia Brittanica on textile subjects, he is the author of several textile publications.

Mr. Goldberg, Research Director of J. P. Stevens and Co., Inc., of New York City, was the official representative of several American textile societies, including the Textile Research Institute ond the American Association of Textile Technologists, at a meeting of the International Organization for Standardization at Buxton, England, last June. He sat on Technical Committee 38 on Textiles.

OBITUARY

STOCKMAN C. PECKHAM

STOCKMAN C. PECKHAM, a member of the Du Pont Company's rayon organization for 20 years, died on March 7, at the Lankenau Hospital, Philadelphia, of pneumonia, following an operation. Mr. Peckham, who was 51, had been ill for several weeks.

A native of Newport, R. I., he entered the wool manufacturing field in 1919 after attending the Lowell Textile Institute. In 1928, when the Du Pont Company was launching its acetate rayon process at Old Hickory, Tenn., he was employed there as a supervisor in the finishing plant.

Mr. Peckham was transferred to the new acetate rayon plant at Waynesboro, Va., in 1929 and remained there for three years, when he was transferred to the sales offices in New York City. Since 1937, when he was transferred to Wilmington, he has worked in technical capacities connected with evaluating new products and the development of uses for new fibers.

MORTIMER COHN

MORTIMER COHN, Vice-President of the Tubular Textile Machinery Corporation, Woodside, N. Y., died suddenly on March 11th. He was 45 years old. Burial services were held at the Riverside Chapel on March 13th.

Mr. Cohn had been with the firm which was founded by his father for 20 years.

He is survived by his wife and two children.

Patent Digest—

(Concluded from Page 296)

U. S. Pat. 2,131,120 (I. G. Farben): alkylene oxide groups are introduced into high molecular compounds such as cellulose, sugar, starch, etc. The alkylene oxide derivatives should further be reacted with alkylesters of organic acids.

U. S. Pat. 2,120,513 (I. G. Farben): a cellulose material is subjected in the presence of an aqueous alkaline liquid to the action of epichlorohydrine and ammonia to improve the dyeing properties.

Other references are:

U. S. Pat. 2,336,985 (Freund): cellulose having attached unsaturated radicals (cellulose aceto crotonate) is described. The purpose is to polymerize this type of product with vinyl esters to obtain threads or permanent finishes. U. S. Pat. 2,406,369 (Sec. of Agric.—Hamilton—Nichols): cellulose acetate is reacted with allyl chloride whereby 1—6 allyl groups are attached to one glucose unit of the cellulosic molecule. The principle of the present invention is that the double bond is linked by a hydroxy bridge to the cellulose molecule.

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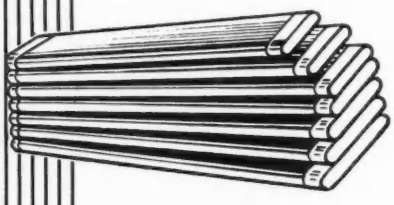

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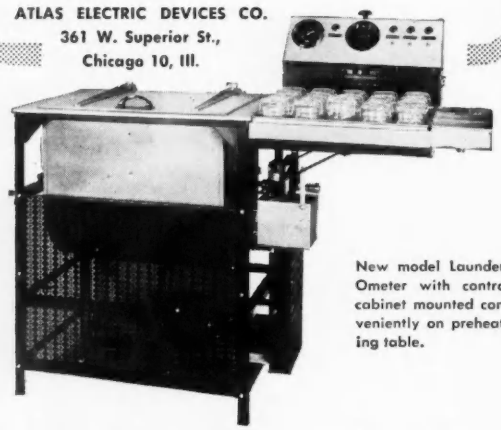

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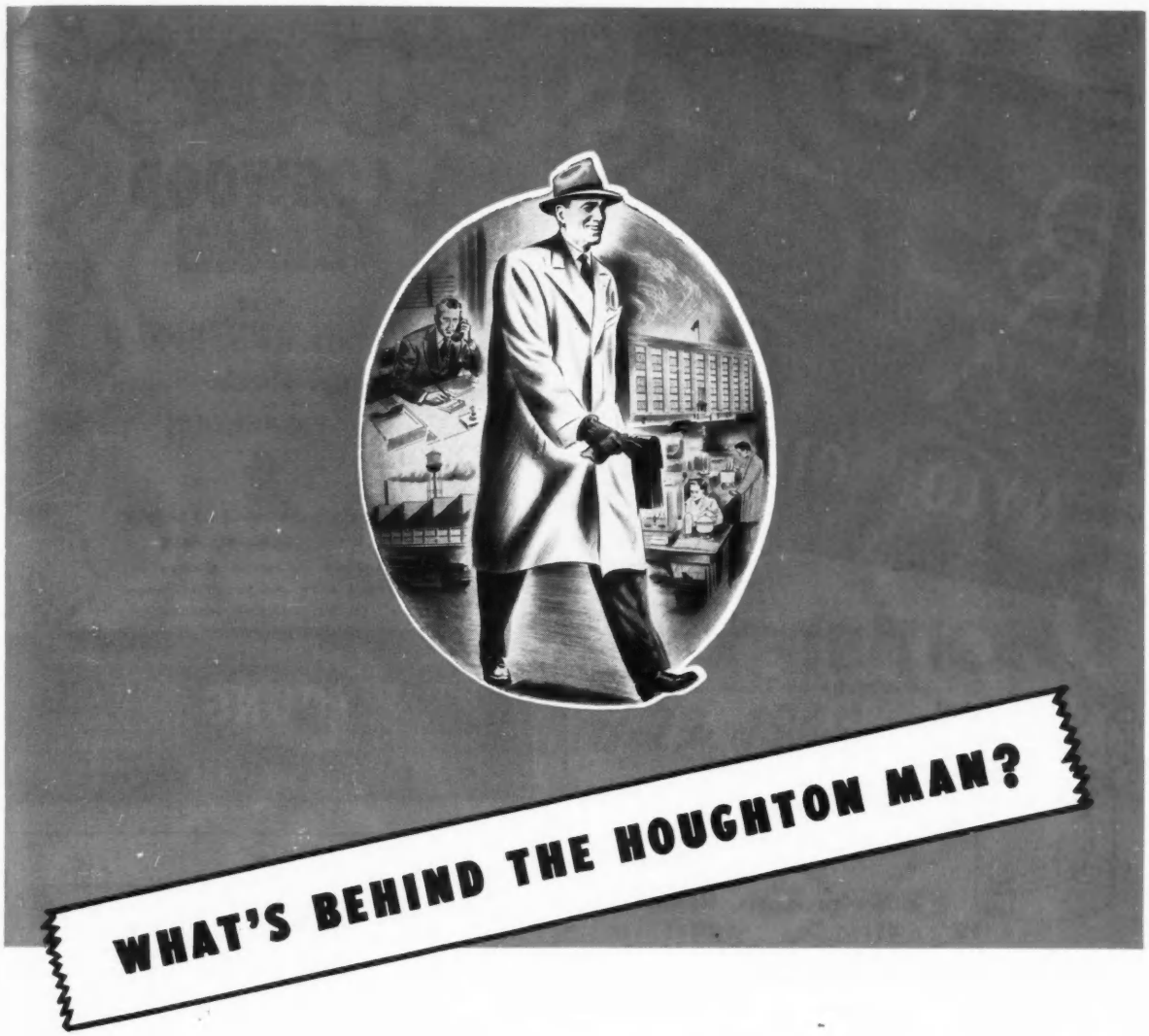

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2-METHYLPENTANEDIOL-2,4	118	197.1	34	Complete	
OCTYLENE GLYCOL	146	244.2	323	4.2	11.7
Ethylene Glycol	62	197.2	21	Complete	
Diethylene Glycol	106	245.0	36	Complete	
Triethylene Glycol	150	287.4	48	Complete	
Propylene Glycol	76	188.2	58	Complete	
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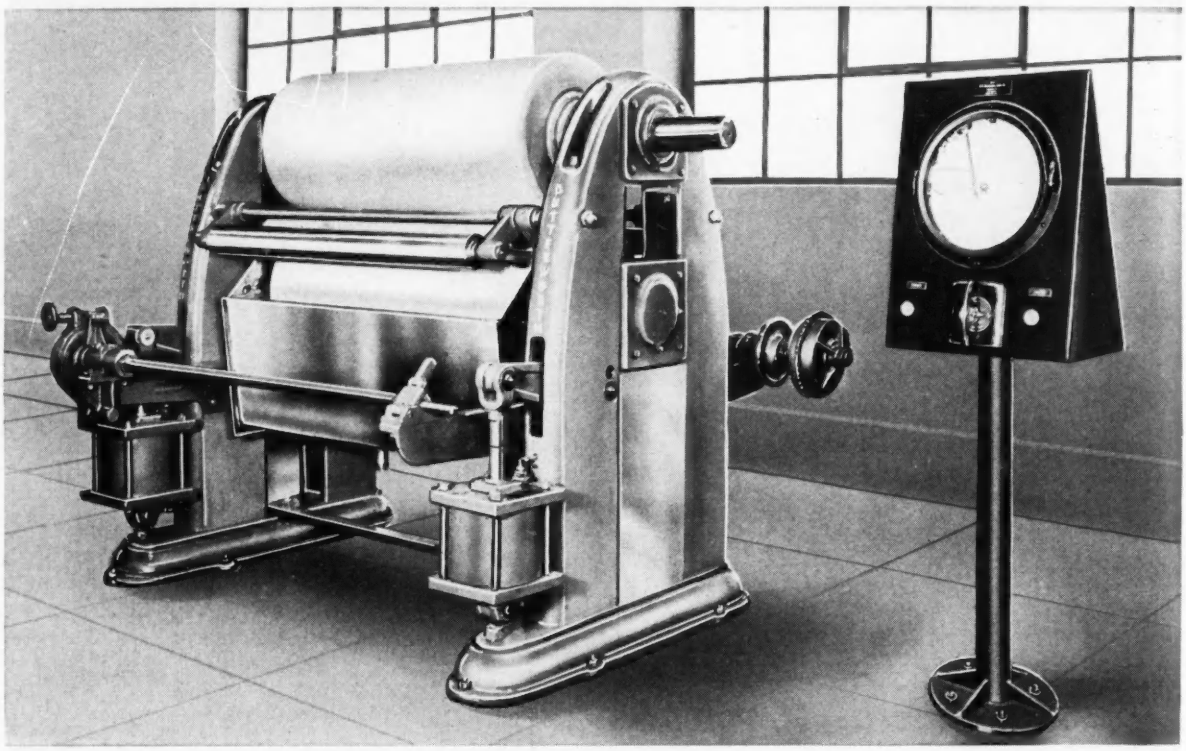

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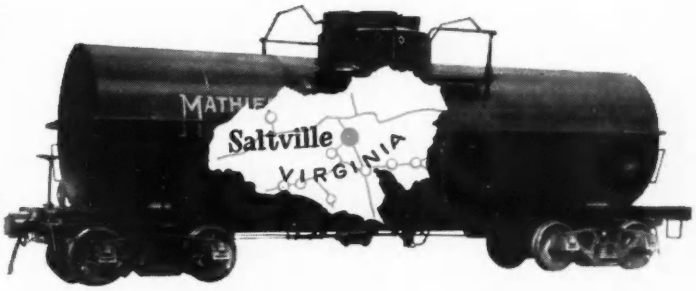

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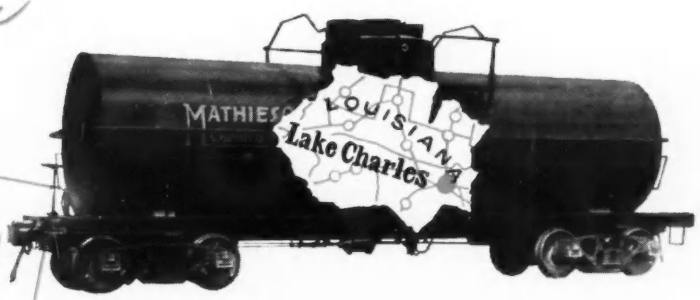

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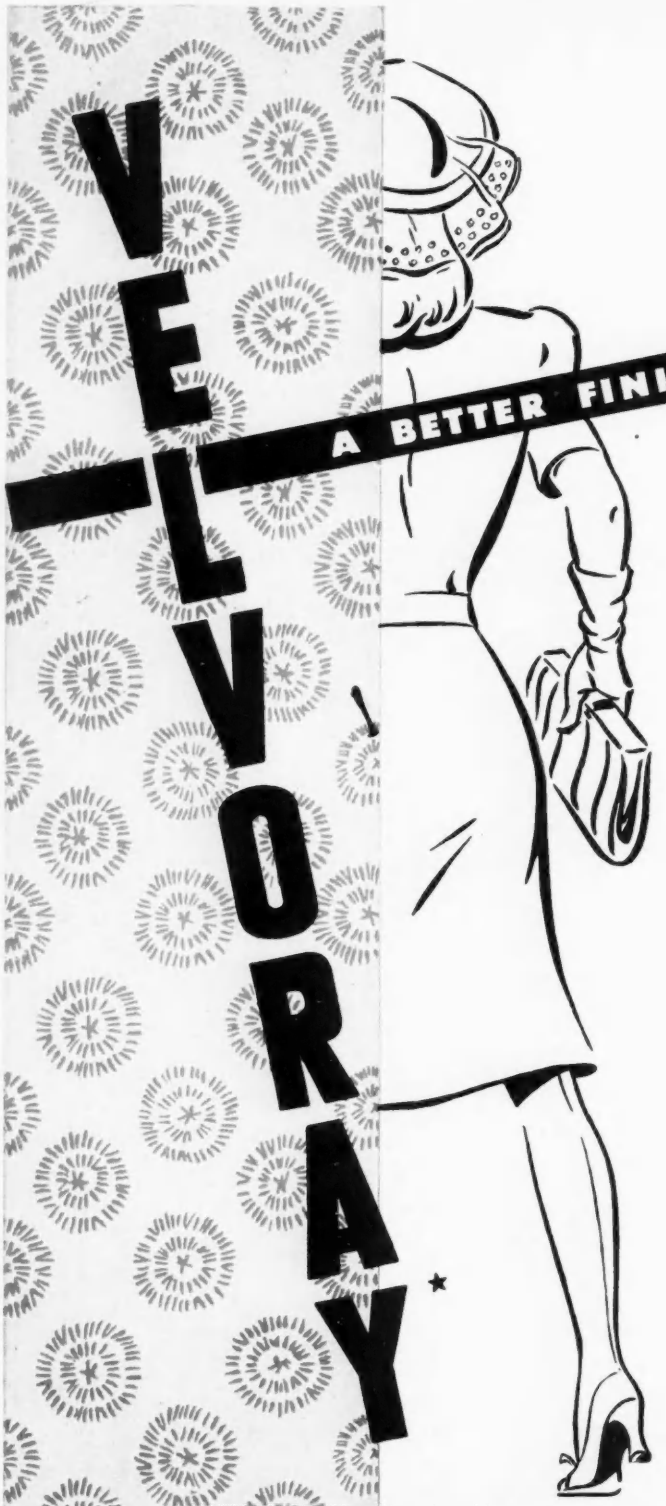

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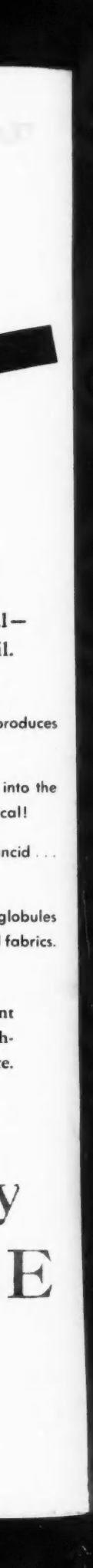
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